QUALITY ASSURANCE PROJECT PLAN
FOR
OPERATIONS AND MAINTENANCE

DELATTE METALS SUPERFUND SITE
PONCHATOULA, TANGIPAHOA PARISH, LOUISIANA
AGENCY INTEREST NO. 2328

PREPARED BY:
SEMS, INC.
11628 S. CHOCTAW DRIVE
BATON ROUGE, LOUISIANA 70815

PREPARED FOR

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL COMPLIANCE

JANUARY 2017

1.0 PROJECT MANAGEMENT

1.1 TITLE AND APPROVAL SHEET

Approved by:

Name, Title: Lourdes Iturralde –Assistant Secretary
Organization: LDEQ - Office of Environmental Compliance

Signature: ______________________ Date: ____________

Name, Title: Gary A. Fulton- Administrator
Organization: LDEQ - UST and Remediation Services Division (RSD)

Signature: ______________________ Date: ____________

Name, Title: Carey Dicharry – Supervisor Geology Group
Organization: LDEQ – UST and Remediation Services Division (RSD)

Signature: ______________________ Date: ____________

Name, Title: Helen Hebert – Contracts and Grants
Organization: LDEQ – OMF

Signature: ______________________ Date: ____________

Name, Title: Fernando Iturralde - Project Manager
Organization: LDEQ – UST and Remediation Services Division (RSD)

Signature: ______________________ Date: ____________

Name, Title: Richard W. Lee – Program Manager

Organization: SEMS Inc. (SEMS) – President

Signature: Richard W. Lee Date: 1-23-17

Name, Title: Brian E. Smith, P.E. – Technical Advisor and QA Officer

Organization: SEMS - Vice President

Signature: BES Date: 1/23/17

Name, Title: Brian H. Sullivan, P.E. – Project Director

Organization: SEMS – Regional Manager

Signature: Date: 1-31-2017

Name, Title: Nick Rodehorst, P.E. – Project Manager

Organization: SEMS

Signature: Date: 1/27/2017

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ATTACHMENTS

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1.3 DISTRIBUTION LIST

QAAP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address
Lourdes Iturralde	Assistant Secretary	LDEQ-OEC	225-219-3710	225-325-8257	lourdes.iturralde@la.gov
Gary A. Fulton	Administrator	LDEQ	225-219-3505	225-219-3708	gary.fulton@la.gov
Carey Dicharry	Supervisor Geology Group	LDEQ	225-219-3609	225-219-3708	carey.dicharry@la.gov
Helen Hebert	Contracts and Grants	LDEQ-OFM	225-219-3815	225-219-3846	helen.hebert@la.gov
Fernando Iturralde	Project Manager	LDEQ	225-219-3665	225-219-3708	fernando.iturralde@la.gov
Ricky Lee	Program Manager	SEMS	225-924-2002	225-924-2004	rlee@semsinc.net
Brian Sullivan	Project Director	SEMS	504-342-2340	504-342-2543	bsullivan@semsinc.net
Brian Smith	Technical Advisor and QA Officer	SEMS	225-924-2002	225-924-2004	bsmith@semsinc.net
Nick Rodehorst	Project Manager	SEMS	504-342-2340	504-342-2543	nrodehorst@semsinc.net
Jerry Sossamon	Alternate Project Manager/ Senior Geologist	SEMS	504-342-2340	504-342-2543	jsossamon@semsinc.net
Rick Tibbs	Field Supervisor	SEMS	504-342-2340	504-342-2543	rtibbs@semsinc.net
Gary Byrd	Alt. Field Supervisor	SEMS	225-924-2002	225-924-2004	gbyrd@semsinc.net
Randy Shackelford	Project Manager	Pace Analytical Services	504-305-3616	504-469-0555	William.shackelford@pacelabs.com
Mike Stewart	Project Manager	Environmental Data Professional	225-205-2114	--	mike@edatapro.com

An electronic copy of this Quality Assurance Project Plan (QAPP) will be maintained on the Louisiana Department of Environmental Management (LDEQ) Intranet Website. The QAPP will be available to all LDEQ personnel. LDEQ will be notified when deviations from the QAPP occur and the QAPP will be revised by the contractor as needed. LDEQ staff listed above will be notified of the posting and any subsequent revisions. Upon LDEQ approval, SEMS Project Manager will email the original QAPP and any subsequent revisions to laboratory and data validator.

1.4 PROJECT/TASK ORGANIZATION

The primary staff and their responsibilities for the management and quality assurance (QA) are provided below.

LDEQ –Lead Organization

1) Project Manager (Fernando Iturralde)

The LDEQ Project manager is responsible for coordination of administrative issues, including approving the QAPP and amendments, review of quarterly reports, notification of property owners of upcoming work, supervise/communicate with environmental contractor and LDEQ representatives.

2) Remediation and UST Services (RSD) Administrator (Gary A. Fulton)

The RSD Administrator is responsible for overall implementation of the Delatte Metals Superfund Site Operations and Maintenance (O&M) associated with the ongoing groundwater sampling, well maintenance, and reporting.

3) Operations Group – Carey Dicharry (Supervisor Geology Group 1), RSD Supervisors, RSD Administrators.

The Operations Group is responsible for overall performance of the Delatte Metals Superfund Site program within the remediation process including the following:

- Team Assignments;
- Supervise the Technical Team; and
- Direct work of and provide assistance to Technical Team

4) The Technical Team consists of a Geologist from RSD and as needed, an Environmental Scientist (ES) from RSD.

The Technical Team is responsible for:

- Assuring that field activities, including those performed by LDEQ staff and contractors, comply with approved standard procedures and quality assurance requirements;
- Overseeing the Contractor's purging and sampling of wells.

SEMS - Environmental Contractor

1) Program Manager (Richard W. Lee)

The SEMS Program Manager oversees project productivity and efficiency, evaluates and supports quality improvements, identifies and implements project-training requirements. The Program manager empowers the Project Director and Project Manager to accomplish project requirements. The Program Manager provides the project's link between all SEMS resources, offices, technical expertise and finances.

2) Project Director (Brian H. Sullivan, P.E.)

The SEMS Project Director is responsible for assuring all project deadlines are met by the project management team. The Project Director is also responsible for assuring that the project has all resources available for the effective completion including personnel, materials, equipment and finances. The Project Director is also responsible for key personnel assignments and assuring that the project is performing to client expectations and satisfaction.

3) Project Manager (Nick Rodehorst, P.E.)

The SEMS Project Manager is responsible for coordination of administrative issues, including preparing the QAPP, scheduling groundwater sampling, preparation of quarterly reports, communication with LDEQ Project Manager, and tracking project status.

4) QA Officer (Brian Smith, P.E.)

The SEMS QA Officer is responsible for reviewing the QAPP, performing annual field audits, reviewing field notes, laboratory reports, and quarterly reports for general best practices and adherence to the QAPP.

5) Technical Staff

Various members of SEMS technical staff will be called upon for field and report work in implementing the O&M Manual.

SEMS Subcontractors

1) Laboratories – (Pace Analytical Services)

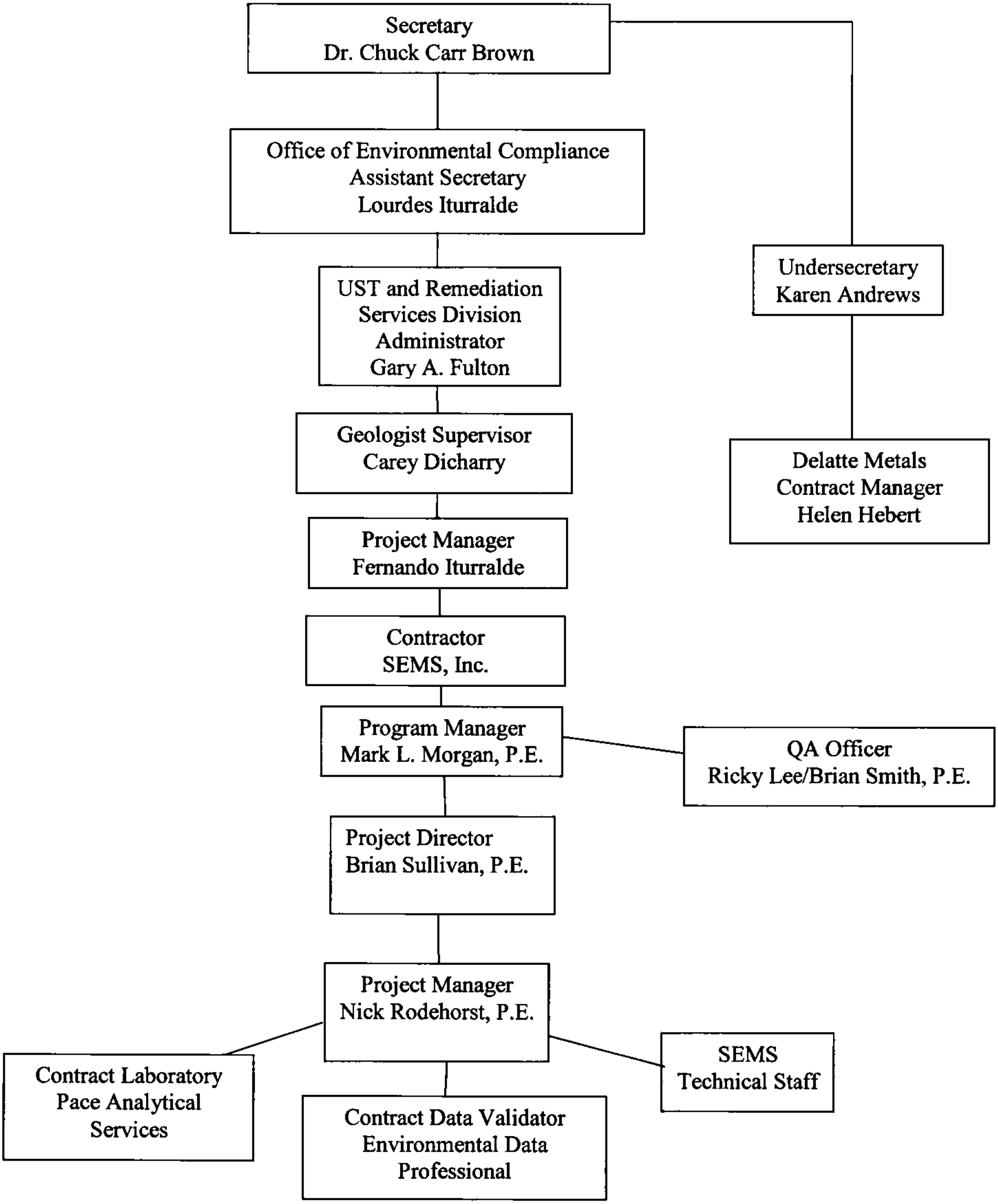
The laboratory will perform analysis on the groundwater samples submitted from the environmental subcontractor and will provide the environmental contractor with analytical data for the quarterly reports including a Level IV QA Package sufficient for validation.

2) Laboratory Data Validator- (Environmental Data Professional)

Third party laboratory validation will be performed on the analytical data generated by the laboratory and the findings submitted to the environmental contractor for the report.

A QAPP Review/Acknowledgement Signature page is included in Attachment E. Key personnel working on the project will review the QAPP and sign the signature page acknowledging the QAPP program requirements and objectives. A copy of the signature page along with a brief summary of any role changes will be submitted to the LDEQ project manager.

1.4.1 PROJECT ORGANIZATION CHART



1.5 INTRODUCTION

SEMS, Inc. (SEMS) was selected by the Louisiana Department of Environmental Quality (LDEQ) for the continued Operations and Maintenance (O&M) at the Delatte Metals Superfund Site, in Tangipahoa Parish, Ponchatoula, Louisiana. Under this work assignment, SEMS is directed to continue the implementation of the O&M Manual dated February 24, 2004 and revised in July 2014. A copy of the O&M Manual is presented in Attachment A. The O&M contract was awarded to SEMS on November 1, 2016. SEMS' contract covers the period from November 1, 2016 through October 31, 2017 with optional second and third year renewal at LDEQ's discretion. SEMS' contract covers all personnel, services, materials and equipment needed to perform the periodic sampling, reporting, and maintenance at the facility.

This quality assurance project plan (QAPP) was prepared to meet the requirements of the contract as detailed in the Delatte Metals O&M Specifications 2016, presented as Attachment B. This QAPP was prepared in accordance with the EPA Uniform Federal Policy for Quality Assurance Project Plans dated March 2005 and includes the four (4) major areas and 25 elements that are described in the guidance. This project-specific QAPP presents quality control (QC) and quality assurance (QA) requirements including the overall project descriptions, organization, responsibilities, quality objectives, and criteria for the successful continued O&M at the Delatte Metals Superfund Site. SEMS has successfully performed O&M at the site since 2007.

This QAPP serves as the basis for ensuring that overall QA objectives for the project are met. Data quality addressed in this QAPP will be sufficient to support the project goals. The QA/QC requirements and activities associated with health and safety requirements are provided in the Health and Safety Plan (HASP) which will be kept onsite during site visits. Sampling and analysis will be conducted on the groundwater and surface water at the site. Any party that generates data under the QA program is responsible for implementing minimum procedures to ensure that the precision, accuracy, completeness, sensitivity, comparability, and representativeness of its data are known and documented.

Many of the sampling and analytical procedures are standard operation procedures (SOPs) which are described in this report and included as attachments to this report including the O&M Manual found in Attachment A.

The QC procedures included in this QAPP are based on site information (1) provided by LDEQ bid specifications, (2) located in the McDonald Construction and SEMS, Inc. quarterly reports and QAPPs, and (3) located in the Tetra Tech QAPP prepared during the remedial action (RA) phase. These procedures are for guidance purposes only and may be modified after LDEQ approval and prior to work at the site being completed.

1.6 PROBLEM PLANNING/ PROJECT DEFINITION

The Delatte Metals Superfund Site is currently under quarterly O&M including groundwater and surface water sampling to determine if constituents of concern (COCs) remediated at the site are not increasing and to ensure that COCs are not migrating horizontally past the permeable reactive barrier (PRB) or vertically into lower water bearing zones. The Delatte Metals O&M Bid Specifications 2016 found in Attachment B and the O&M Manual found in Attachment A define the work to be completed at the site under this QAPP.

1.6.1 Project Definition Site History and Background

According to the February 2005 QAPP developed by McDonald Construction, the 19-acre Delatte Metals Superfund Site includes the Delatte Metals, Inc. facility and the abandoned North Ponchatoula Battery Facility. These facilities are aggregated because they are adjacent, performed identical lead salvage operations, and generated the same type of waste. Delatte Metals, Inc., which operated a lead smelter to recover additional lead materials, began operation in the early 1970's as the Fuscia Battery Company and ceased operations in 1993. The Ponchatoula Battery Company moved its operation adjacent to the Delatte and Fuscia Battery Company between 1972 and 1978.

The physical location of the site is approximately 5.5 miles south-southeast of Hammond, Louisiana, 1.5 miles southeast of Ponchatoula, Louisiana, and adjacent to the new Delatte Recycling, LLC whose physical address is 19113 Weinberger Road, Ponchatoula, Louisiana.

The site lies to the north of Weinberger Road, in a rural area with numerous residences within a one-mile radius of the site. The latitude and longitude for the site are 30°25'16"N and 90°24'39"W, respectively. The surrounding area is used for growing crops such as bell peppers, strawberries, and soybeans. Minor amounts of land are used for harvesting timber. Weinberger Road followed by residences bound the site to the south, drainage ditches and residence to the north and east, and Selsers Creek and a residence to the west.

During LDEQ and EPA investigations, discharge from the facilities showed a pH range from 0.55 to 2 standard units. Analytical samples from on-site soil and groundwater samples indicated the presence of heavy metals including Lead, Arsenic, and Cadmium. An observed release of Lead and Cadmium to Selsers Creek was documented by the analytical data from the sediment samples collected at three probable points of entry.

Remedial action (RA) operations costing approximately $14 million began on November 18, 2002 and the implementation was completed on September 22, 2003. During the RA, the principle threat wastes were excavated, immobilized, and transported off-site for disposal. A permeable reactive barrier wall (PRB) was installed to neutralize the acidity of the shallow water-bearing zone and limit the migration of dissolved metals. Following implementation of the RA, an O&M program was put in place to ensure the effectiveness of the selected remedy. The initial O&M program consisted of quarterly groundwater monitoring of 26 monitoring wells and 5 water wells. In September 2013 the O&M program was modified to include sampling of 39 monitoring wells, 5 water wells, and 5 surface water sampling locations. For the RA to be effective the groundwater down gradient of the PRB should be ever approaching neutrality and the metal concentrations in groundwater should demonstrate either a stable or preferably decreasing trend.

1.6.2 PHYSICAL CHARACTERISTICS OF THE DELATTE METALS SITE

This section discusses the physical characteristics of the site, including surface-water hydrology, regional geology and hydrogeology, and site geology/hydrogeology.

1.6.2.1 Surface Water Hydrology

Major surface water features at the site consist of Selsers Creek and its tributaries and the ditches along Weinberger Road. Cypress Swamp, located southwest of the facility across Weinberger Road, drains to Selsers Creek. Most of the site surface water runoff from the site flows to tributaries of Selsers Creek. The ditches along Weinberger Road drain to Selsers Creek or to low-lying land, which then drains to the South Slough. Selsers Creek flows to the South Slough, which eventually flows to Lake Maurepas. According to the Louisiana Administrative Code (LAC 33, Part IX) Selsers Creek, South Slough, and Lake Maurepas have designated water uses as primary contact recreation, secondary contact, and fish and wildlife propagation (A, B, and C, respectively).

The Federal Emergency Management Agency Flood Insurance Rate Map indicates that the northwest side of the northern end of the site is located in the 100-year flood plain. The remainder of the site is located in the 500-year flood plain.

1.6.2.2 Geology and Hydrogeology

Three distinct and local water bearing zones (WBZ) consist of grayish-white to tan and fine to coarse grained sand with gravel. The three WBZ are located at the site from ground surface to approximately 100 feet below ground surface (ft-bgs). The First WBZ is generally found between 5 and 15 ft-bgs. This zone is semi-confined on its sides and is overlain by sandy/silty clay across the northern section of the site. During the Remedial Investigation (RI), a clay unit was encountered underneath this First WBZ.

The Second WBZ encountered at the site generally consists of intermittent layers of gray, tan, and orange clayey silt. At various locations, this WBZ is typically encountered between 15 and 40 ft-bgs. The Second WBZ appears to be confined and relatively continuous across the site.

The Third WBZ encountered at the site consists of light brown to gray silty sand and sand. During the RI, this Second WBZ was encountered between 58 and 62 ft-bgs, extending to the maximum depth of the site borings (100 ft-bgs). The Third WBZ appears to be confined and continuous across the site.

According to the LDEQ Risk Evaluation/Corrective Action Program (RECAP) analysis of hydrology and water quality, the three WBZs can be classified as follows:

- The First WBZ is Class 3B (a source of a moderate quantity of water, with total dissolved solids (TDS) concentrations greater than 10,000 milligrams per liter (mg/L)).
- The Second WBZ is Class 2C (a source that could potentially supply drinking water in sufficient quantity for a domestic water supply, but because it has a TDS concentration between 1,000 and 10,000 mg/L, it is not of sufficient drinking water quality).
- The Third WBZ is Class 1B (a source that could potentially or currently does supply drinking water to a domestic water supply and has a TDS concentration of less than 1,000 mg/L).

Underneath the three local WBZs identified at the site are three regional aquifers: The Shallow Aquifer (also known as the Upland Terrace Aquifer), the Ponchatoula Aquifer (which is subdivided into two units: the upper and lower Ponchatoula Aquifers), and the Tchefuncte Aquifer.

The Shallow Aquifer underlying southern Tangipahoa parish consists of medium sand and gravel deposits of the lower coastal terrace, along with younger flood plain deposits from major streams. The aquifer is usually less than 100 ft-bgs in the southern section of Tangipahoa Parish, and the unit grades into clay and sandy clay. Transmissivities in this aquifer range from 70,000 to 350,000 gallons per day per foot. Hydraulic conductivities range from 70 to 140 feet per day. Wells installed in the Shallow Aquifer are mostly used for domestic purposes. Wells used for irrigation and livestock watering are also installed in the Shallow Aquifer. The Third WBZ and deepest identified local WBZ at the site is equivalent to the Shallow Aquifer. The other two identified aquifers, the Ponchatoula Aquifer and the Tchefuncte Aquifer, are located beneath the Shallow Aquifer and are not hydraulically connected.

1.7 PROJECT PLANNING

The contractor will perform periodic groundwater and surface water sampling at the site under the O&M Manual found in Attachment A. During the periodic sampling events the monitor wells will be inspected and repairs will be made as needed and approved by the LDEQ. The

PRB will be inspected for subsidence or cracks. Periodic reports will be submitted within thirty days following the end of the sampling period.

A total of 39 monitoring wells and five (5) water wells will be sampled in accordance with the LDEQ bid specifications to ensure the effectiveness of the PRB and the verify containment of groundwater pollutants. The purpose of the groundwater monitoring program is to ensure that the groundwater pH downgradient of the PRB is approaching neutrality, that metals concentrations downgradient of the PRB are decreasing, and that metals concentrations in the groundwater of the Third WBZ are not increasing.

The frequency of groundwater sample collection varies at each well. Monitoring wells screened in the First and Second WBZ will be sampled on a semi-annual basis. Monitoring wells screened in the Third water bearing zone will be sampled on an annual basis. The onsite and offsite water supply wells will be samples on a quarterly basis. Five (5) surface water samples will be collected on a semi-annual basis. Appendix C – Table 3 of the O&M Manual summarizes the frequency of sample collection at each sample location.

Periodic monitoring of the well network will be required to obtain at least eight time-independent data points that will be evaluated using statistical tools to quantitatively assess pH, metals, sulfides, and sulfates concentrations. Intra-well trends and populations trends (up-gradient and down-gradient) in metals concentrations and pH will be used to evaluate the efficiency of the remedy and to recommend changes to the monitoring program, as necessary (See Section 4.2.1).

Inspections will be made of deed files 650403, 674854, and 674853 for the institutional controls limiting site reuse to industrial at the Tangipahoa Parish Clerk of Court.

1.8 QUALITY OBJECTIVES AND CRITERIA

As outlined in the O&M Manual, groundwater samples will be collected using low flow micropurging technique and will be analyzed for total metals. Low flow groundwater sampling procedures are found in Attachment C. If the turbidity of a sample is above 10 NTU after parameters have stabilized, then the sample will be additionally analyzed for dissolved metals.

Groundwater at monitoring wells screened in the First WBZ and located downgradient of the PRB will also be analyzed for sulfates and sulfides concentrations. Water quality will also be measured in the field following the stabilization of the water parameters including temperature, pH, conductivity, turbidity, oxidation–reduction potential, and dissolved oxygen. Five (5) water wells will be sampled after the water is allowed to flow for 15 minutes. Surface water samples will be collected following the SOP 1134 included in Appendix B of the O&M Manual. A detailed discussion of the Quality Objectives can be found in Section 3.2 of the O&M Manual. Appendix C – Table 3 of the O&M Manual summarizes the analyses that are required for each sample location.

1.9 SECONDARY DATA EVALUATION

Sampling data including water quality parameters, analytical results, figures, and site history will be obtained from previous reports submitted to LDEQ located on the LDEQ Electronic Data Management System (EDMS) servers to create quarterly and semi-annual reports. Historical surface water data and data from the monitoring wells installed by the USGS and EPA are not available and trend analysis will not be performed until eight (8) data points have been collected at these sampling locations.

SEMS was not provided with a scaled drawing of the Delatte Metals Superfund Site and created a site drawing from one of the drawings in the O&M Manual and previous reports. The contractor will not hire a surveyor to verify the accuracy of this map and will assume that it is correct. The scale and accuracy is limited to the quality of the previous drawings and copies.

The location and depth of the monitoring wells is based upon data gathered during the RA project and data obtained from the USGS and EPA. Tables showing the construction details of the monitor wells and information on the water wells are provided in Appendix C – Tables 1 and 2 of the O&M Manual, respectively. Accuracy of these measurements lies solely on data collected by the EPA contractor assigned during well installation.

1.10 PROJECT OVERVIEW AND SCHEDULE

The O&M Manual and the Delatte Metals O&M Bid Specifications 2016 dictate the proposed scope of work and project tasks outlined for this project.

1.10.1 Project Overview

The environmental contractor is to perform the work in the O&M Manual to monitor the site. This QAPP plan is developed to assign roles and responsibilities and to assure that the work meets the standards of the O&M Manual. The following tasks will be completed as part of the existing SEMS contract and O&M Manual:

- Prepare a QAPP
- Monitor wells and PRB Inspection
- Review Institutional Controls
- Perform periodic sampling
- Oversee Lab Analysis
- Oversee Data Validation
- Submit quarterly and semi-annual reports
- Repair and maintain site wells as necessary

1.10.2 Project Schedule

The project schedule is outlined in the Delatte Metals O&M Bid Specifications 2016 bid package and is summarized in the table below:

Table 1.10.2 Project Schedule

Due Dates	Activity
November 1, 2016	Contract awarded to SEMS
November 7, 2016	Submittal of Draft QAPP to LDEQ for review
November 8-11, 2016	Perform Q4 groundwater sampling event
November 30, 2016	Submit Final QAPP to LDEQ
January 31, 2016	Submit 4th Quarter and 2nd Semi-annual Operational Report to LDEQ
January – March 2016	Perform Q1 groundwater sampling event
April 30, 2016	Submit 1st Quarter Operational Report to LDEQ

April – June 2016	Perform Q2 groundwater sampling event
July 31, 2016	Submit 2nd Quarter and 1st Semi-annual Operational Report to LDEQ
July – September 2016	Perform Q3 groundwater sampling event
October 31, 2016	Submit 3rd Quarter Operational Report to LDEQ.
November 1, 2016	Contract is up for renewal

While delays are not expected, if encountered they may affect the project schedule and the LDEQ project manager will be notified in advance for extension requests to the schedule.

2.0 MEASUREMENT/DATA ACQUISITION

2.1 SAMPLING TASKS

A total of 39 monitoring wells and five (5) water wells from three separate WBZ will be sampled periodically as outlined in O&M Manual and the Delatte Metals O&M Bid Specifications 2016. Groundwater from monitoring wells screened in the First and Second WBZ will be sampled on a semi-annual basis. Groundwater from monitoring wells screened in the Third WBZ will be sampled on an annual basis. Groundwater from the offsite and onsite water supply wells will be sampled on a quarterly basis. Additionally, five (5) surface water sample locations will be sampled on a semi-annual basis.

2.1.1 Sample Process Design

The contract did not provide the rationale for the wells being sampled. However, as stated in the O&M Manual, the wells were chosen to ensure the effectiveness of the PRB and to verify containment of groundwater COCs. Groundwater monitoring activities will include well sampling to determine that the groundwater pH down-gradient of the PRB is approaching neutrality, that metals concentrations in the groundwater down-gradient of the PRB are decreasing, and that the metals concentrations in the ground water of the Third WBZ are not increasing.

2.1.2 Sampling Procedures and Requirements

As outlined in the O&M Manual samples will be collected using low flow micropurging technique and will be analyzed for total metals for the 39 monitor wells. If the turbidity of a sample is above 10 NTU after water quality parameters have stabilized, the sample will be field filtered and analyzed for total and dissolved metals. Water quality will also be measured in the field using a flow through-cell following the stabilization of the water parameters including temperature, pH, conductivity, turbidity, oxidation–reduction potential, and dissolved oxygen. The five water wells will be sampled after the water is allowed to flow for 15 minutes. Surface water samples will be collected in accordance with SOP 1134 in Appendix B of the O&M Manual. A detailed discussion of the Quality Objectives can be found in Section 3.2.2 of the O&M Manual.

2.1.3 Sampling Collection Procedures

As stated above groundwater from the monitor wells will be sampled using low flow micropurging. The EPA Ground Water Issue " Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures " document dated April 1996 will be used for low flow procedures and is presented in Attachment C. Surface water samples will be collected in accordance with SOP 1134 in Appendix B of the O&M Manual.

2.1.4 Sample Containers, Volume and Preservation

A single 250 milliliter (mL) polyethylene container preserved with nitric acid (HNO_3) will be used for total or dissolved metals analysis. The holding time for metals analysis is 180 days. A single 250 mL polyethylene container preserved with Zinc Acetate Sodium Hydroxide (ZnAcNaOH) will be used for sulfide analysis. The holding time for sulfide analysis is 7 days. A single 250 mL polyethylene unpreserved container will be used for sulfate analysis. The holding time for sulfate analysis is 28 days. The sample container, volume, and hold times are further discussed in Section 3.2.1 of the O&M Manual.

2.1.5 Equipment/Sample Containers and Decontamination

All equipment that comes into contact with the groundwater at the site will be decontaminated and the fluids will be containerized onsite for disposal. Disposable material (i.e. gloves and tubing) that came into contact with the groundwater at the site will be containerized and disposed of at an appropriate facility. Decon water, purge water, and waste liquid will be segregated from solid waste material and both will be containerized separately in 55-gallon drums. The

Contractor shall be responsible for removing and disposing of the waste in accordance with federal and state regulations.

2.1.6 Field Equipment Calibration, Maintenance, Testing & Inspection Procedures

Each well has its own dedicated polyethylene tubing that will be inspected each sampling period for damage and contamination before sampling the well so as to further ensure that cross contamination does not occur. Any tubing found to be defective will be removed from the well and containerized for proper disposal. Contractor personnel who sample the monitoring wells will clean and inspect all sampling equipment thoroughly between each well to ensure that cross contamination does not occur. The performance and/or any deviation from established protocol will be detailed in the daily field notes. The laboratory analyzing samples will be responsible for documenting inspection, testing, and maintenance of their instruments in accordance with applicable EPA/LDEQ methods, manufacturer's specifications and their own SOPs.

Calibration of sampling equipment will be performed prior to each sampling period to ensure proper accuracy. The sampling equipment used will conform to and will be calibrated by procedures detailed in SOP No. 15 in Appendix B of the O&M Manual.

2.1.7 Supply Inspection and Acceptance Procedures

Inspection/Acceptance of supplies and consumables will be performed by the contractor prior to bringing supplies onsite and prior to use. Any supplies that are not considered to be acceptable will be returned to the vendor for replacement or repair. Any additional inspection will be at the discretion of LDEQ personnel.

2.2 ANALYTICAL TASKS

All monitoring wells will be sampled using the MicroPurge method outlined in SOP No. 15 in the site O&M Manual. Surface water samples will be collected in accordance with SOP no. 1134 in the site O&M Manual. Further details on sampling methods and requirements are set forth in Section 3.2.2 of the O&M Manual.

The pH of the well will be recorded following the water quality parameters reaching equilibrium as stated in the SOP No. 15 of the O&M Manual.

The samples submitted to the lab will be analyzed for total or dissolved metals which will follow the SW-846 6020 or 6010 method as approved by LDEQ, which is equivalent to the analytical method EPA ILM 05.2[b] which is set forth in the site O&M Manual Section 3.2.4 (see Table 1 Analytical Methods for additional details on methods used). Samples that require sulfates and sulfides analysis will follow the SW-846 Method 9056 and Method 9034, respectively.

2.2.1 Analytical SOPs

The subcontracted analytical laboratory will be Louisiana Environmental Laboratory Accreditation Program (LELAP) accredited and able to perform the total and dissolved metals analysis using Inductively Coupled Plasma – Mass Spectroscopy (ICP-MS) following the SW-846 Method 6020 or 6010 as outlined in their SOP for analyzing total and dissolved metals. The laboratory will report arsenic, cadmium, lead, manganese, nickel, and zinc only. Sulfates and sulfides analysis will be performed following the SW-846 Method 9056 and 9034 SOP, respectively.

2.2.2 Analytical Instrument Calibration Procedures

The subcontracted analytical laboratory will follow the calibration procedure for total and dissolved metals analysis outlined in SW-846 Method 6020 or 6010 and their SOP for instrument calibration. The subcontracted analytical laboratory will follow the calibration procedure for sulfates and sulfides analysis outlined in SW-846 Method 9056 and 9034 and their SOP for instrument calibration. Records will be maintained in a secured format for a minimum of 5 years.

2.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures

The subcontracted laboratory will follow the instrument manufacturer's guidelines for maintenance and will document such maintenance in an Instrument Maintenance Log.

2.2.4 Analytical Supply Inspection and Acceptance Procedures

Inspection/Acceptance of analytical containers, provided by the laboratories, will be performed by the contractor prior to bringing containers onsite and prior to use. Additionally all sample shipments will be inspected for physical condition and chemical preservative by the lab on receipt from the field. Any additional inspection will be at the discretion of LDEQ personnel. Any sample containers that appear compromised will be returned to the laboratory for replacement or will be resampled if rejected by the laboratory.

2.3 SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CHAIN OF CUSTODY PROCEDURES

Chain-of Custody procedures will be followed by the contractor and laboratory to ensure that the sample process is secure from tampering. The integrity of the samples will be assured by proper storage on ice in a secure environment. Accurate chain-of-custody forms will be completed and will accompany samples to the laboratory to assure verification and validity of the samples.

Sample Handling and Custody Requirements are set forth in Section 3.2.3 of the O&M Manual. The contractor and laboratory will follow sampling protocol and samples that are compromised during transportation to the laboratory will be resampled. A copy of the Chain-of Custody to be used during the sampling events is included in Attachment D.

2.4 QUALITY CONTROL SAMPLES

Quality control methods and requirements are set forth in section 3.2.5 of the O&M Manual.

2.4.1 Sampling and Analytical Quality Control Samples

The following sampling and analytical quality control samples will be collected to measure the influence of sampling and analytical procedures as outlined in Section 3.2.5 of the O&M Manual:

- Field Duplicates (1 every 10 samples)
- Matrix Spike/ Matrix Duplicate (MS/MD) (1 every 20 samples)

No equipment, field, or trip blanks were requested in the O&M Manual or the Delatte Metals O&M Bid Specifications 2016.

2.5 DATA MANAGEMENT

Data sources include measurements made in the field, analytical data generated by the analytical laboratory, and a third party analytical validation report.

- Field Measurements include:
  - -Water Level
  - -pH recording
  - -Groundwater quality parameters
  - -Monitor well inspections
  - -PRB inspections
- Analytical Laboratories
  - -Analytical data will be provided by the laboratory with a data package sufficient to perform validation (Similar to Level IV).
- Third Party Analytical Validation
  - -Validation of analytical data shall occur quarterly with at least 10% of the data being validated.

Field notes will be prepared during each visit to the site. A copy of field notes will be included with the quarterly report. Copies of the field forms to be used during quarterly sampling can be found in Attachment D. Data management methods and requirements are further outlined in section 3.2.6 of the O&M Manual.

3.0 ASSESSMENT AND OVERSIGHT

3.1 ASSESSMENTS AND RESPONSE ACTION

Assessment of field sampling procedures will occur once per year by the SEMS QA Officer. Additionally a review of the field notes, analytical data and report will be completed quarterly by the SEMS QA Officer. Following this review, the SEMS Project Manager will be notified of any deficiencies and will note them in periodic reports.

The condition of the wells will be assessed each time they are measured or sampled. Any damaged wells will be repaired as outlined on page 17 of the Delatte Metals O&M Bid Specifications 2016 and Section 4.0 of the O&M Manual. The condition of the site will also be observed during the sampling period and any corrective action needed will be noted and reviewed by SEMS and LDEQ for a resolution.

SEMS will walk the PRB and visually inspect the PRB quarterly for subsidence and cracking as outlined on page 15 of the Delatte Metals O&M Bid Specifications 2016. If any repairs or soil is needed, SEMS will notify the LDEQ Project Manager.

The contractor will verify quarterly that institutional controls are in place as outlined on page 15 of the Delatte Metals O&M Bid Specifications 2016.

Laboratory personnel will assess sample transportation, storage, and data acquisition techniques. Laboratory personnel will note the temperature of the cooler if sample bottles are not full, are leaking, or were not chemically preserved. The contractor will be notified of any defective samples and they will be retaken as needed.

Third party data validation will be conducted on a minimum of 10% of the analytical data for the site to ensure that the data are valid and defensible.

The LDEQ will review the field work and periodic reports at their discretion and make recommendations as needed.

3.2 QA MANAGEMENT REPORTS

The SEMS QA Officer will report any deficiencies and corrections in the periodic reports following their review of the data

The laboratory will generate the equivalent of a Level IV, fully supported data package that will allow a review by the third party data validation.

3.3 PROJECT REPORTING

Quarterly and semi-annual reports will be prepared as stated in Section 5.0 of the O&M Manual. The data from the offsite and onsite water wells will be reported on a quarterly basis. The data from the 1st and 2nd WBZ wells and surface water sample locations will be reported on a semi-annual basis. The data from the 3rd WBZ wells will be reported on an annual basis. The reporting schedule for each sample location is provided in Appendix C – Table 3 of the O&M Manual. The periodic report will include a summary of operations, a data summary table providing the current operations, and a data summary table providing current and cumulative quantities for the following:

1. A facility map showing all monitoring wells and depicting their status;
2. A table showing well number, well depth, screened interval, zone monitored, well diameter, casing material, and type of dedicated equipment for each well;
3. A table showing the sampling and reporting schedule for each well at the facility;
4. A table showing which tests are performed for each well and the specific constituents of concern;
5. A summary of analytical data from all monitoring wells for the reporting period;
6. A discussion of any significant changes from the previous reporting in the analytical data from all monitoring wells for the reporting period;
7. Contaminant concentration isopleths for each monitored zone for the reporting period;
8. Water Level Measurements and Potentiometric surface maps for each zone monitored for the reporting period;
9. Contaminant concentration versus time graphs for all monitoring wells installed to monitor the effectiveness of the recovery system;
10. Copies of lab data reports, along with validation reports;
11. Original field forms/notes,
12. Waste disposal manifests,
13. Chronology of events,

14. LDEQ correspondence/requests,
15. Unusual findings or conditions,
16. Effectiveness of current remedial approach,
17. Site O&M recommendations; and
18. Other pertinent information or discussion.

All required documents and records will be supplied by SEMS in the periodic report. Any amendments to these documents will be made at the request of LDEQ. Copies of these documents will be supplied to applicable LDEQ personnel for processing.

4.0 DATA REVIEW

4.1 OVERVIEW

The analytical data collected at this facility will be submitted for third party validation. Additionally the QA Officer will review the field notes and data quarterly for adherence to the QAPP.

4.2 DATA REVIEW STEPS

The criteria and methods used to review and validate collected sample data are stated in section 3.3 of the O&M Manual and includes a third party review of a minimum of 10% of the analytical data. The most current version of the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review will be used for data validation.

Specific performance criteria, validation, and verification methods are provided in detail in section 3.2 of the O&M Manual.

4.2.1 TREND ANALYSIS

SEMS will provide a historical summary of the past eight quarters groundwater analytical and potentiometric data. Historical data trend graphs will also be developed for the previous eight quarters that show pH, arsenic, cadmium, lead, manganese, nickel, and zinc concentrations over time. For samples reported below laboratory detection limits, the reporting detection limit was used for graphing purposes. The historical data trend graphs were completed in Excel and a linear regression trend line was generated by Excel using at most the previous eight quarters of data for each COC. Following eight quarters of data collection sulfates and sulfides trends will also be reviewed. A brief discussion of the trend based on the regression line will be discussed in the report for wells with at least two quarters of analytical data exceeding site cleanup or RECAP SS.

Long term trends of monitor wells in the first water bearing zone will also be reviewed from 2006 to present to determine if the PRB is working to increase the pH towards neutrality. Upgradient wells (BA-03 and DW-02) and down gradient wells (MW-01 and DW-01) were chosen to evaluate the effectiveness of the PRB. Additionally a monitor well (DW-03) was evaluated as it is on the outside of the PRB. Additional wells or statistical analysis may be reviewed as necessary.

4.3 STREAMLINING DATA REVIEW

The QAPP, field and reporting activities will be reviewed on an annual basis and any proposed changes to the QAPP will be submitted to the LDEQ for approval.

TABLES

TABLE 1
ANALYTICAL METHODS

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Analytes Tested[1]	Analytical Method Used	Detection[2] Limit (mg/L)	Screening Option Used	Limiting Standard (mg/L)
Total or Dissolved Arsenic	SW-846 6020 or 6010	0.004	RECAP SS	0.010
Total or Dissolved Cadmium	SW-846 6020 or 6010	0.002	RECAP SS	0.005
Total or Dissolved Lead	SW-846 6020 or 6010	0.001	EPA Site Cleanup	0.015
Total or Dissolved Manganese	SW-846 6020 or 6010	0.002	RECAP SS	0.510
Total or Dissolved Nickel	SW-846 6020 or 6010	0.002	RECAP SS	0.073
Total or Dissolved Thallium	SW-846 6020 or 6010	0.002	RECAP SS	0.002
Total or Dissolved Zinc	SW-846 6020 or 6010	0.01	RECAP SS	1.1
Sulfate	SW-846 9056	1	EPA SMCL[3]	250
Sulfide	SW-846 9034	0.02	NA[3]	NA

Notes:

[1] Dissolved samples are collected as needed based on turbidity, and field filtered.

[2] Detection limits are based on pre dilution limits. If dilution is needed these limits will be adjusted to reflect the dilution.

[3]No Site Cleanup standards or RECAP Standards exist for sulfate or sulfide. The 250 mg/L sulfide standard is an EPA secondary drinking water regulation based upon aesthetic qualities of color and odor.

ATTACHMENT A

OPERATIONS AND MAINTENANCE (O&M) MANUAL

DELATTE METALS SUPERFUND SITE (REVISED JULY 2014)

OPERATION AND MAINTENANCE MANUAL
DELATTE METALS SUPERFUND SITE
PONCHATOULA, TANGIPAHOA PARISH, LOUISIANA
EPA ID NO. LAD052510344
LDEQ AGENCY INTEREST NO. 2328

PREPARED FOR
LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

REVISED JULY 2014

APPENDICES

LETTER	TITLE
A	FORMERLY INCLUDED HEALTH AND SAFETY PLAN (See LDEQ Specifications)
B	STANDARD OPERATING PROCEDURES
C	TABLES
D	FIGURES
E	TREND ANALYSIS FOR INTRAWELL COMPARISONS; COMPARISONS OF UPGRADIENT VERSUS DOWNGRADIENT WELLS
F	LANDOWNER CONTACTS (Information in Appendix F is not provided based on the presence of private personal data.)

ACRONYMS AND ABBREVIATIONS

COC	Chain-of-custody
Delatte	Delatte Metals Superfund Site
EPA	U.S. Environmental Protection Agency
ETD	Environmental Technology Division
HASP	Health and Safety Plan
HNO3	Nitric acid
LDEQ	Louisiana Department of Environmental Quality
MCL	Maximum contaminant level
MS/MD	Matrix spike/matrix duplicate
µm	Micrometer
NTU	Nephelometric turbidity units
O&M	Operation and Maintenance
OEA	Office of Environmental Assessment
PPE	Personal protective equipment
PRB	Permeable reactive barrier wall
QA	Quality Assurance
QC	Quality Control
RA	Remedial Action
SOP	Standard operating procedure
Tetra Tech	Tetra Tech EM Inc.
WBZ	Water-bearing zone

1.0 INTRODUCTION

This operation and maintenance (O&M) manual was prepared for the U.S. Environmental Protection Agency (EPA) for use at the Delatte Metals (Delatte) Superfund Site located in Ponchatoula, Tangipahoa Parish, Louisiana. The Louisiana Department of Environmental Quality (LDEQ) official site name is Delatte Metals site, Agency Interest No. 2328. The EPA official site name is "Delatte Metals Superfund Site," EPA No. LAD052510344. This O&M Manual was revised by the LDEQ Remediation Services Division in July of 2014 due to changes in scope regarding recommended modifications to the O&M program made by the EPA following a 5-year review of the site.

As described in the Record of Decision, the remedial action (RA) was to address the contamination in the soil, sediment, surface water, and ground water at the site by:

- Immobilization to address the principal threat wastes in the soil (thus eliminating the source of contamination for sediment, surface water, and ground water);
- Off-site disposal to transport immobilized wastes to a disposal facility;
- Installation of permeable reactive barrier walls (PRB) to neutralize the acidity of the shallow ground water and limit the migration of dissolved metals;
- Implementation of institutional controls in the form of deed notices to inform the public of site conditions; and Ground water monitoring to ensure the effectiveness of the selected remedy.

During the RA, the principal threat wastes in the soil were excavated, immobilized, and transported offsite for disposal, and a permeable treatment wall was installed to neutralize the acidity of the shallow ground water and limit the migration of dissolved metals. However, the site was not restored to levels that allow for unlimited use and unrestricted exposure.

The Comprehensive Environmental Response, Compensation, and Liability Act Section (§§)121(c), as amended, states the following:

"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented."

The National Oil and Hazardous Substance Pollution Contingency Plan §300.430(f)(4)(ii) states the following:

"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

The purpose of the O&M manual is to describe the actions needed to verify that the institutional controls are in place and to describe the ground water monitoring program used to ensure the effectiveness of the remedy. As part of the RA, EPA will monitor the wells at the site for a period of one year after construction completion. The purpose of this monitoring is to ensure that the monitoring wells are functioning properly, that the PRB was constructed properly, and that baseline water quality conditions are established via monitoring. Ground water downgradient of the PRB will be monitored to verify that the pH is increasing and that the metals concentrations are decreasing. Ambient surface water at Selsers Creek and the northern tributary (Tributary 1) will also be monitored for pH and metals concentrations. Ground water downgradient of the PRB will also be monitored for sulfates and sulfides concentrations. The Third water-bearing zone (WBZ) will be monitored to ensure that no downward migration occurs. On September 22, 2004, one year after construction completion, the RA report was finalized and the O&M began under the State of Louisiana, through the Department of Environmental Quality.

This manual describes the long-term O&M activities that will be required at the Delatte site in order to ensure the effectiveness, protectiveness, and integrity of the remedy. This O&M manual includes: (1) safety requirements, (2) monitoring program, and (3) routine maintenance and inspection procedures. To the extent practicable, routine O&M and sampling activities will be performed following standard operating procedures (SOP) that have been developed as part of the RA quality assurance (QA) program (Appendix B). Use of SOPs will help ensure that data collected is reproducible and technically defensible.

The O&M manual is divided into five chapters. Section 1.0 provides an introduction and general overview of the O&M manual. Section 2.0 describes general health and safety information. Section 3.0 discusses the ground water monitoring program. Section 4.0 describes routine maintenance and inspection activities to be completed. Section 5.0 describes the reporting. The references used in this O&M manual are listed in Section 6.0.

Appendix A formerly included a Health and Safety Plan (H&SP); however, refer to the LDEQ Specifications document requiring health and safety requirements. Appendix B includes SOPs pertaining to activities that will take place during the O&M period at the Delatte site. Tables are included as Appendix C. Figures are included as Appendix D. Appendix E includes information pertaining to trend analyses for intrawell comparisons. Appendix F includes contact information for landowners (this information is not provided in this report due to the presence of private personal data).

2.0 HEALTH AND SAFETY

O&M activities and physical features of the site may expose field personnel to a variety of hazards. All personnel involved in the routine on-site O&M activities must receive training in accordance with Occupational Safety and Health Administration 1910.120, including 40-hour initial Hazardous Waste Site Worker certification with a current 8-hour annual refresher. Refer to the LDEQ Bid Specifications document for information regarding health and safety requirements.

Physical hazards associated with O&M activities may pose a threat to on-site personnel. Dangers may include heavy equipment, slippery surfaces, unseen obstacles, noise, heat, cold, snake bites, and poor illumination. Injuries may result, for example, from the following:

- Accidents caused by slips, trips, or falls
- Use of improper lifting techniques
- Use of moving or rotating equipment
- Equipment mobilization and operation

- Use of improperly maintained equipment

Injuries resulting from physical hazards can be avoided by using safe work practices and employing caution when working with machinery. Physical hazards that have been identified at this site include the following:

- Slips, trips, and falls
- Moving equipment
- Noise
- Lifting and carrying
- Biological hazards

Appropriate personal protective equipment (PPE) should be worn while performing O&M duties at the Delatte site.

3.0 MONITORING PROGRAM

In order to ensure the effectiveness, protectiveness, and integrity of the remedy, long-term monitoring activities at the Delatte site will include sampling to determine that the ground water pH downgradient of the PRB is increasing, that metals concentrations in the ground water downgradient of the PRB are decreasing, and that the metals concentrations in the ground water of the Third WBZ are not increasing. The ambient surface water at Selsers Creek and Tributary 1 will also be monitored for pH and metals concentrations. Metals that will be sampled were identified during the site investigation and include arsenic, cadmium, lead, manganese, nickel, and zinc. The shallow ground water downgradient of the PRB will also be monitored for sulfates and sulfides concentrations. This section describes the procedures for collecting ground water samples from the on- and off-facility monitoring wells, the on-facility water wells, and nearby off-facility water wells.

3.1 SAMPLING ACTIVITIES

A total of 44 on- and off-facility monitoring wells and water wells will be sampled as part of this monitoring program. Of these, 22 wells are screened in the First WBZ, 13 wells are screened in the Second WBZ, 4 wells are screened in the Third WBZ, and 5 wells are water-supply wells. The monitoring well locations are provided in Appendix D – Figure 1. Monitoring well construction details are summarized in Appendix C – Table 1. Of the five wells that are water supply wells, there are two on-facility water wells and three nearby off-facility water wells. Details regarding the water wells are listed in Appendix C – Table 2.

A total of five surface water sample locations (CA-41, CA-51, CL-19, CL-05, and Bridge). The surface water sample locations and nomenclature included in this O&M plan are consistent with surface water sample locations previously sampled by the EPA and referenced in their "Evaluation of Groundwater/ Surface Water Interactions Final Report (SERAS0051-RF-070912), with the exception of the "Bridge" sample location. The "Bridge" sample location was previously referred to as CA-61 in the EPA reports. Surface water sample locations are shown on Appendix D – Figure 2.

The frequency of sample collection varies at each well. Monitoring wells screened in the First and Second WBZ will be sampled on a semi-annual basis. Monitoring wells in the Third WBZ will be sampled on an annual basis. On and off site water supply wells will be sampled on a quarterly basis. Surface water samples will be collected on a semi-annual basis. A summary of the sample collection frequency for each sample location is provided as Appendix C – Table 3.

Additional wells and piezometers installed by EPA Robert S. Kerr Environmental Research Center in and around the PRB will be sampled separately by EPA and are not included in this O&M Manual.

Before sampling activities begin, the appropriate landowners will be contacted by LDEQ to inform them of the activities on their respective properties. Current landowner contacts are included in Appendix F. All on-facility monitoring wells will be sampled using low-flow sampling techniques in an effort to (1) obtain samples that are representative of the mobile load of contaminants present, (2) to minimize disturbance of the sampling point thereby minimizing sampling artifacts, (3) minimize sampling variability between sampling events, (4) minimize drawdown, (5) minimize casing water mixing, (6) minimize the need for filtration, and (7) reduce pumping volume.

The samples will be analyzed for total metals when the turbidity measurements stabilize below 10 nephelometric turbidity units (NTU). If water quality parameters have stabilized within the allowable variances and the turbidity is above 10 NTU, the sampling team will collect a total and dissolved metals sample. Samples analyzed for total metals will not be filtered; however, the dissolved metals samples will be filtered in the field using a 0.45-micrometer [µm] membrane filter. The ground water pH measurements as well as the turbidity measurements will be measured in the field.

Any data set evaluated for trends over time will have at least eight time-independent data points and a minimum detection rate of 50 percent (EPA 2000). As the number of observations grows over time, so does the certainty of observed trends. Therefore, in order to perform statistical data analysis, quarterly monitoring of the well network will be required to obtain at least eight time-independent data points. Ground water data collected during the last year of RA and the first year of O&M will be evaluated using statistical tools to quantitatively assess metals concentrations and pH. Intra-well trends and population trends (upgradient and downgradient) in metals concentrations and pH will be used to evaluate the efficacy of the remedy and to recommend changes to the monitoring program, as necessary.

3.2 QUALITY ASSURANCE ACTIVITIES

This section addresses the requirements for consistent collection of quality ground water samples and data. Various SOPs are included in Appendix B.

3.2.1 Sample, Container, Volume, Preservation, and Holding Time Requirements

A representative fraction of ground water from each well shall be placed directly into containers. One 250-milliliter (mL) polyethylene container preserved with nitric acid (HNO3) will be used for total metals analysis. If the turbidity remains above 10 NTU after water quality parameters have stabilized, then a disposable 0.45-µm inline filter will be installed in the line and a filtered sample will also be collected in a 250-mL polyethylene container preserved with HNO3 for dissolved metals analysis. One unpreserved 250-mL polyethylene container will be used for sulfates analysis. One 250-mL polyethylene container preserved with Zinc Acetate Sodium Hydroxide (ZnAcNaOH) will be used for sulfides analysis. Sample containers will be sealed to prevent leakage and then stored in an ice chest at 4 EC. Appendix C – Table 4 summarizes the required sample analytical methods, volumes, preservation, and holding time requirements.

3.2.2 Sampling Methods

Sampling methods and equipment have been selected to meet project objectives. The sampling team shall use EPA-approved methods for sample collection and field measurements. All monitoring wells will be sampled using a low-flow or micropurging technique outlined in SOP No. 15, included in Appendix B. All surface water samples will be collected as outlined in SOP 1134, Revision 6, included in Appendix B.

Prior to sampling, monitoring wells will be unlocked and uncapped by site personnel to allow them to vent for a minimum of 15 minutes. The sampling team will use a water level indicator to determine the static water level and total depth of the well. All monitoring wells will be sampled using a low-flow or micropurging technique. Water quality parameters including temperature, pH, conductivity, turbidity, oxidation-reduction potential, and dissolved oxygen will be taken in the field using a flow-through cell and allowed stabilize to within the criteria outlined in SOP No. 15. The flow-through cell will be used in order to allow regular or continuous measurements and minimize contact between the water and air. As the water moves through the flow-through cell, readings will be taken every 3 minutes and the well pH value determined after pH has stabilized. The pH will be stable when a fluctuation of +/-0.1 pH unit is obtained from three successive readings. If water quality parameters have stabilized within the allowable variances and the turbidity is below 10 NTU, the sampling team will collect a total metals sample. If water quality parameters have stabilized within the allowable variances and the turbidity is above 10 NTU, the sampling team will collect total and dissolved metals samples. If the recharge rate is so slow that even low flow cannot be maintained, the respective wells will be purged dry and sampled within 24 hours of being purged dry.

The on- and off-facility water supply wells will be sampled by opening existing valves and allowing the water to run for a minimum of 15 minutes. At this time, a sample will be collected in a 250-mL plastic container preserved with HNO3. If the wells are not operational for any reason, these water supply wells will not be sampled.

Surface water samples within Selsers Creek will be collected approximately five feet from the edge of the bank at the vertical midpoint of the creek. Surface water samples collected from Tributary 1 will be collected from the middle of the tributary. All surface water samples will be collected following SOP 1134, Revision 6 provided in Appendix B.

Following purging and sampling, all equipment that comes into contact with the groundwater at the site will be decontaminated and the fluids will be containerized onsite for disposal. Disposable material (i.e. gloves and tubing) that came into contact with the groundwater at the site will be containerized and disposed of at an appropriate facility. Decon water, purge water, and waste liquid will be segregated from solid waste material and both will be containerized separately in 55-gallon drums. The Contractor shall be responsible for removing and disposing of the waste in accordance with federal and state regulations. According to the LDEQ Bid Specifications, waste disposal events should occur before the volume of collected purgewater reaches approximately 80 percent of the onsite storage capacity.

The sampling team will be responsible for addressing failures in the sampling or measurement systems and will implement corrective action in these situations. In general, corrective action for field sampling and measurement failures include recalibration of instruments, replacement of malfunctioning measurement instruments or sampling equipment, and resampling or repetition of measurements.

3.2.3 Sample Handling and Custody Requirements

Each sample collected will be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Sample integrity helps to ensure the legal defensibility of the analytical data and subsequent conclusions. The sampling team will use standard EPA procedures to identify, track, monitor, and maintain chain-of-custody (COC) for all samples. These procedures include the following:

- Field COC procedures
- Field procedures
- Field logbooks
- Laboratory COC procedures

3.2.4 Laboratory Analytical Methods

Laboratory analyses of field samples will be conducted by a laboratory capable of analyzing for site metals in ground water. The laboratory will use analytical methods and standards presented in the contract-laboratory program statements of work. The analytical methods are summarized in Appendix C – Table 3. In all cases, appropriate methods of sample preparation, cleanup, and analyses are based on specific analytical parameters of interest, sample matrices, and required detection limits. Note: Refer to the LDEQ Bid Specifications document regarding laboratory accreditation.

3.2.5 Quality Control Requirements

Field and laboratory quality control (QC) samples and measurements will be used to verify that analytical data meet QA objectives. Field QC samples and measurements will be used to assess the influence of sampling activities and measurements on data quality. Laboratory QC samples will be used to assess the influence of a laboratory's analytical program on data quality. The field and QC requirements for samples provide definitions and typical collection and analysis frequencies of common field and laboratory QC samples and measurements. They also outline the procedures used to assess field measurements, laboratory data, and common data quality indicators.

Field duplicate samples are independent samples collected as close as possible, in space and time, to the original sample. Immediately following collection of the original sample, the field duplicate sample is collected by using the same collection method. Field duplicate samples can measure the influence of sampling and field procedures on the precision of an environmental measurement. Field duplicates should be collected at a frequency of one for every 10 samples collected.

Matrix spike/matrix duplicate (MS/MD) samples are laboratory QC samples that are collected in the field. For aqueous samples, MS/MD samples require two times the normal volume for inorganic analysis. Analytical results of the MS/MD samples are used to measure the accuracy of the inorganic analytical program. One MS/MD sample should be analyzed for every 20 ground water samples collected.

3.2.6 Data Management

Data for this project will be obtained from a number of sources, including field measurements and subcontracted laboratories. The data gathering process requires a coordinated effort and will be conducted by the Contractor's project staff members in conjunction with all potential data producers. The data will be obtained from the analytical service provider, when appropriate, in the form of an electronic data deliverable, in addition to the required hard copy analytical data package. Third party validation of data will be conducted before associated results are presented or are used in subsequent activities. See the LDEQ Bid Special Terms and Conditions for analytical data validator requirements.

Data tracking is essential to ensure timely, cost-effective, and high-quality results. Data tracking begins with sample COC. When the analytical services provider receives custody of the samples, the provider will send a sample acknowledgment to the Contractor's project team. The sample acknowledgment will confirm sample receipt, condition, and required analyses. The tracking program will contain all pertinent information about each sample and can track the data at each phase of the process. The tracking program carries the data through completion of the data validation.

Ten percent (10%) of the analytical data shall be validated to ensure that the confirmatory data are accurate and defensible. As a part of the data validation process, the electronic data deliverables will be reviewed against the hard copy deliverables to ensure the accurate transfer of data. In addition, the hard copy will be evaluated for errors in the calculation of results. After the data validation, qualifiers can be placed on the data to indicate the usability of the data. These qualifiers will be placed into the electronic data file. Upon approval of the data set with the appropriate data qualifiers, the electronic data will be released to the Contractor's project manager for reporting.

3.3 DATA ANALYSIS AND STATISTICAL TESTING

Ground water data collected during the monitoring program will be evaluated using statistical tools to quantitatively assess pH, metals, sulfates, and sulfides concentrations in ground water. The Contractor shall conduct the statistical analysis at the completion of the second year (last year of RA and the first year of O&M) of sampling when at least 8 time-independent data points at a minimum detection rate of 50 percent (EPA 2000) have been obtained. Intra-well trends and population trends (upgradient and downgradient) in pH, metals, sulfates, and sulfides concentrations will be used to evaluate the efficacy of the remedy and to recommend changes to the monitoring program, as necessary. The following sections discuss data preparation, tests for trends, statistical tests comparing site data against cleanup levels, and statistical tests comparing upgradient and downgradient concentrations.

3.3.1 Data Preparation

All data sets will be screened for rejected records ("R" qualified data), and these data will be excluded from the working data sets (Appendix E). Statistical quantities for metals with nondetected results ("U" qualified data) will be calculated using one-half the reporting limit as a substituted value for the nondetected result. This simple substitution provides a reasonable approximation of summary statistics if the detection rate is 85 percent or greater (EPA 2000). Other methods of substitution are recommended for metals with detection rates less than 85 percent but greater than 50 percent; however, although EPA provides guidelines for handling nondetect data (EPA 2000), it recognizes that no general procedures are applicable in all cases.

Descriptive summary statistics will be calculated after 2 years (8 quarters) of sample data have been collected. Data sets will also be evaluated for distribution and outliers using statistical plots and/or statistical tests for distribution, (such as the Shapiro-Wilk test), and for outliers (such as the Rosner test).

Data may be grouped by well or by WBZ for the statistical testing. Statistical graphs and exploratory data analysis will be employed to select the appropriate data grouping and the appropriate statistical tests. Several types of statistical tests (described in the following paragraphs) may be applied to the chemical data collected during the ground water monitoring program at the Delatte site.

3.3.2 Test for Trends

Trend analysis is a statistical tool used to detect and estimate temporal or spatial trends in a data set. Trend analysis is a useful way to evaluate changes within one well or sampling location. Preferably, any data set evaluated for trends over time will have at least eight time-independent observations and a minimum detection rate of 50 percent (EPA 2000). As the number of observations grows over time, so does the certainty of observed trends.

There are several different statistical tests that may be used to evaluate whether a trend exists, with a given probability. The Mann-Kendall test, the Kendall tau test, and Sen's Slope Estimator are appropriate nonparametric tests that are less sensitive to outliers than parametric regression methods. Regression control charts provide graphic depictions of trends and confidence intervals, but unlike the Mann-Kendall and Sen's Slope Estimator, regression control charts are parametric tests that assume a linear relationship between two variables. The characteristics of each data set will be evaluated to determine the appropriate tests to apply.

Trend analysis can be used to evaluate whether the concentrations of a constituent within a single well have increased or decreased over a particular time period. Data will be evaluated in the O&M report to ascertain if contaminant concentrations in each well show statistically significant increases or decreases over time. The critical question for the Delatte site is, "Are concentrations of contaminants in ground water sampled at the site increasing or decreasing over time, as shown by trends in concentrations at each well?"

3.3.3 Statistical Tests Comparing Site Data Against Cleanup Levels

Statistical tests used to compare a data set against a fixed numerical value such as a regulatory standard or threshold value are called "one-sample" tests. Despite the name, these tests actually compare one population (i.e., one data set) against a fixed value, such as an maximum contaminant level (MCL). One-sample tests include both parametric and nonparametric tests. A parametric test, such as the one-sample t-test, assumes that the data are normally (or lognormally) distributed, whereas a nonparametric test, such as the Wilcoxon Rank Sum test, does not assume a particular distribution for the data. Therefore, if the distribution is unknown or if it violates the normality assumption, a nonparametric test may have more power than a corresponding parametric test.

Data from the ground water monitoring program at Delatte will be evaluated using appropriate groupings of the data, as determined by exploratory data analysis. Data may be grouped by well (after 8 quarters of data have been collected), by WBZ, or other type of natural grouping deduced by the exploratory data analysis. Data sets for each group will then be compared to the appropriate fixed value using the most appropriate statistical test.

3.3.4 Statistical Tests Comparing Upgradient and Downgradient Concentrations

"Two-sample" tests are used to compare two data sets (for example, site versus ambient data), rather than two samples (as the name may imply). These tests include both parametric and nonparametric tests. Two-sample parametric tests include the two-sample t-test. Nonparametric tests include the Wilcoxon Rank Sum, the quantile test, and the slippage test. The Wilcoxon Rank Sum test compares the median values of two data sets, whereas the quantile and slippage tests examine the data values in the upper portion of the distribution of the two data sets. Two-sample tests may or may not be useful for evaluating ground water quality at the Delatte site; however, applicability and usefulness of such tests will be examined.

3.3.5 Evaluation of Total and Dissolved Metals

The results of the total and dissolved metals from each well will be compared in order to assess what portion of the metals are suspended and dissolved. These data will be compared to turbidity measurements made during sampling. If the turbidity measured during sampling is less than 10 NTU, the total metals results are considered to be representative of the mobile load in the aquifer and it will not be necessary to collect both filtered and total metal samples. If the turbidity is greater than 10 NTU, a filtered sample will be collected to evaluate the mobile dissolved concentration in the aquifer. Total concentrations minus the dissolved concentrations will be the non-mobile portion (if the total is greater than the dissolved).

3.3.6 Graphing and Contouring Data

The water level results obtained from each monitoring well will be used to develop contour maps and contaminant concentration maps. Contour maps will be developed from each round of sampling and for all three WBZs. The contaminant concentration maps will be developed for each metal of concern within each WBZ. Contaminant data from each well will be plotted graphically to show changes in concentration over time which will aid in the evaluation of trends.

4.0 ROUTINE MAINTENANCE AND INSPECTION

The Contractor shall perform routine maintenance and visual site inspections at the Delatte site to ensure the integrity of the RA. Inspections should be made of the monitoring network. A listing of a schedule of events is presented in Appendix C – Table 5.

The monitoring wells will be maintained and repaired as necessary. All monitoring wells will be properly labeled and locked. The condition of each monitoring well will be noted during each ground water sampling event and, if necessary, corrective action should be taken. Monitoring wells will be inspected to see if they have suffered any damage since the previous visit due to vehicular traffic, vandalism, or other damage (including screen deterioration). Damage to the concrete pad surrounding each well will be noted, and if severe, the pad may require removal and replacement. Rust or damage to the protective cover may require repainting, or if severe, replacement. Locks that are missing or inoperable will be replaced. If the monitoring well is damaged, it will be evaluated for possible repair. If the damage cannot be repaired, the need for the well will be evaluated based on the previously collected data. If this evaluation shows that the well is still needed, the damaged well will be plugged and abandoned and a replacement well will be installed. If during sampling the well become clogged with sediment, the excess sediment will be removed from the wells by first agitating the water column with a surge block and then removing the sediment with a bailer. If during O&M, the monitoring program changes to remove wells from the sampling schedule, then these wells will be plugged and abandoned.

The deed files for the property will be inspected by the Contractor during the time of sampling to ensure that ICs remain in place.

5.0 REPORTING

Quarterly and semi-annual reports will be prepared describing the sampling activities that occurred, the sample results, the observations made during the site inspection, and the presence of ICs in the deed files will be completed. Recommended corrective measures for issues identified during the inspection will be presented. Statistical analysis of collected data will not be performed until eight sampling events have been conducted. The data from the offsite and onsite water supply wells will be reported on a quarterly basis. The data from the First and Second WBZ wells and the surface water sample locations will be reported on a semi-annual basis. The data from the Third WBZ wells will be reported on an annual basis. The reporting schedule for each sample point is provided in Appendix C – Table 3.

Specifically, as listed in the LDEQ Bid Specification Document, each report shall include the Contractor's name and address, the name of the Project Manager, LDEQ's contract number and project title, a narrative summary of the quarter's operations, and a data summary table providing quarterly and cumulative quantities for the following items:

(1) A facility map showing all monitoring wells, and depict their status, i.e., assessment, recovery, P/A, etc;
(2) A table showing well number, well depth, screened interval, zone monitored, well diameter, casing material, and type of dedicated equipment, i.e., pump, bailer, etc. for each well;
(3) A table showing the sampling and reporting schedule for each well at the facility;
(4) A table showing which tests are performed for each well and the specific constituents of concern;
(5) A summary of analytical data for all monitoring wells for the reporting period;
(6) A discussion of any significant changes from the previous reporting period in the analytical data from all monitoring wells for the reporting period;
(7) Contaminant concentration isopleths for each monitored zone for the reporting period;
(8) Water level measurements and potentiometric surface maps for each zone monitored for the reporting period;
(9) Concentration versus time graphs for all monitor wells installed to monitor the

effectiveness of the recovery system;

(10) Copies of lab data reports, along with validation reports;

(11) Original field forms / notes; and

(12) Other pertinent information or discussion.

Note: After the trend analysis, Quarterly Reports shall include a comparison of the quarterly sampling results to the statistical analysis.

6.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 2000. "Guidance for Data Quality Assessment Practical Methods for Data Analysis". EPA QA/G-9.EPA/600/R-96/084. July.

EPA. 1996. "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods." SW-846. Third Edition. Update III. December.)

EPA. 2001. "EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration (ILM05.2)." October.

Tetra Tech. 2002. "Quality Assurance Project Plan for Remedial Action, Delatte Metals Superfund Site, Ponchatoula, Tangipahoa Parish, Louisiana". Prepared for EPA under Contract No. 68-W6-0037.
December 19.

Tetra Tech. 2000. "Delatte Metals Remedial Investigation Report, Ponchatoula, Louisiana". January.

LDEQ. 2013. "Specifications – Operation and Maintenance at the Delatte Metals Superfund Site." Invitation to Bid #3000002160. September.

APPENDIX A

FORMERLY INCLUDED HEALTH AND SAFETY PLAN

(See LDEQ Specifications)

APPENDIX B

STANDARD OPERATING PROCEDURES

- **SOP 002** **General Equipment Decontamination**
- **SOP 014** **Static Water Level, Total Well Depth, And Immiscible Layer Measurements**
- **SOP 015** **Groundwater Sample Collection Using Micropurge Technology**
- **SOP 019** **Packaging And Shipping Samples**
- **SOP 024** **Recording Of Notes In Field Logbook**
- **SOP 1134** **Water Sampling Procedures**

SOP 002

GENERAL EQUIPMENT DECONTAMINATION

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 2

Last Reviewed: December 1999

RMiesing

Quality Assurance Approved

February 2, 1993

Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. "RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles

- Alconox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, and general sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off-site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums.

Personnel decontamination procedures will be as follows:

1. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

2. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

3. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

4. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

5. Remove disposable gloves and place them in plastic bag for disposal.

6. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on-site before drilling operations begin, between borings, and at completion of the project.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting.

The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket using a stiff, long bristle brush and Liquinox or Alconox solution.

2. Steam clean the sampling equipment over the rinsate tub and allow to air dry.

3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.

4. Containerize all water and rinsate.

5. Decontaminate all pipe placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Wipe the sounding cable with a disposable soap-impregnated cloth or paper towel.
2. Rinse with deionized organic-free water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (methanol or hexane) rinse, if applicable or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (methanol or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

SOP 014

STATIC WATER LEVEL, TOTAL WELL DEPTH, AND IMMISCIBLE LAYER MEASUREMENTS

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

STATIC WATER LEVEL, TOTAL WELL DEPTH, AND IMMISCIBLE LAYER MEASUREMENT

SOP NO. 014

REVISION NO. 0

Last Reviewed: December 1999

R Riesing

Quality Assurance Approved

July 20, 1994

Date

1.0 BACKGROUND

Measurement of static water level, total well depth, and any immiscible layers is necessary before a well can be sampled and groundwater flow direction can be determined. If an immiscible layer is present, its depth and thickness must be determined. In addition, the static water level and total depth of a monitoring well are needed to determine a purging volume.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide guidelines for field personnel measuring static water levels and total water depths of monitoring wells or piezometers. This SOP also provides guidelines for measuring immiscible layers in such wells.

1.2 SCOPE

This SOP describes the methodologies for measuring static water level, total well depth, and immiscible layer depth and thickness.

1.3 DEFINITIONS

To clarify the methodologies presented in this SOP, the following definitions are presented:

Electrical Water Level Indicator: An electrical probe used to determine the depth to fluid. The probe has a light or sound alarm connected to an open circuit. The circuit is closed and the alarm is activated when the probe contacts a conducting fluid such as water.

Immiscible Layer: A liquid phase that cannot be uniformly mixed or blended with water. Heavy immiscible phases sink in water; light immiscible phases float on water.

Interface Probe: An electrical probe used to determine the thicknesses of light or dense immiscible layers in the water column of a monitoring well.

Ionization Detector: A photoionization detector (PID) or a flame ionization detector (FID) is used to measure the level of volatile organic compounds in the gaseous phase. These units are generally not compound-specific and thus measure only total volatile organic compounds. The PID generally cannot detect as complete a range of compounds as the FID. This difference is the result of the relative ionization energies of the two detectors. Most PIDs cannot detect methane, but FIDs can. The HNu and Microtip are examples of PIDs; the Foxboro organic vapor analyzer (OVA) is an example of an FID.

Static Water Level: The level of water in a monitoring well or piezometer. This level can be measured as the depth to water or as the elevation of water relative to a reference mark or datum.

Total Well Depth: The distance from the ground surface to the bottom of a monitoring well or piezometer

1.4 REFERENCES

SOP No. 002, General Equipment Decontamination

U.S. Environmental Protection Agency. 1994. "Water Level Measurement." Environmental Response Team SOP #2043 (Rev. #0.0, 10/03/94). On-Line Address: http://204.46.140.12/media_resrcs/media_resrcs.asp?Child1=

1.5 REQUIREMENTS AND RESOURCES

The equipment required for measuring static water levels, total well depths, and immiscible layers is as follows:

- Electrical water level indicator
- Interface probe
- PID or FID

2.0 PROCEDURES

This section provides general guidance followed by specific procedures for static water level, total well depth, and immiscible layer measurement.

Techniques for measuring depth to water and depth to the bottom of a monitoring well should be identified in the planning stage of field work. Also at this stage, measuring devices should be chosen, and an individual should be assigned to take and record measurements.

All measurement instruments should be decontaminated before and after use and between measurement locations. Refer to SOP No. 002, General Equipment Decontamination.

Before initiating any measuring activities, the ambient air at a monitoring well head should be monitored for possible emissions of volatile organic compounds. To accomplish this monitoring, a PID or an FID should be used. The health and safety plan for on-site activities should provide action levels and the rationale for selection of either detector.

Appropriate respiratory protection equipment should be worn by the sampling team. Wells should be approached from the upwind side. When opening the monitoring well, the sampling team should systematically survey the inside of the well casing, the area from the casing to the ground, the area from above the well casing to the breathing zone, and the area around the well. Readings for comparison to action levels should be taken not within the well casing but in the breathing zone. If PID or FID readings of volatile organic compounds are above action levels, the sampling team should retreat to a safe area and put on appropriate safety gear. The site-specific health and safety plan should be consulted for action levels.

2.1 STATIC WATER LEVEL MEASUREMENT

The procedure described below should be followed to measure the static water level in a monitoring well or piezometer.

An electric water level indicator is typically used for static water level measurement. The electrical probe of the indicator should be lowered into the monitoring well until the light or sound alarm is activated, indicating that the probe has touched the water surface. The static water level should then be read directly from the indicator to the 0.01-foot fraction. If the monitoring well top is not flush with the ground surface, the distance between the static water level and the top of the riser pipe should be measured; the height of the riser pipe above ground surface should then be subtracted from the first measurement to determine the depth to static water below ground surface. If surveyed elevations are available, they should be used to establish the water level elevation. To ensure measurement accuracy, the probe should be left hanging above the water surface in the monitoring well; a series of three readings should be taken, and the values should be averaged. The measurement date and time, individual readings, and the average of the readings should be recorded in a field logbook.

2.2 TOTAL WELL DEPTH MEASUREMENT

The procedure described below should be followed to measure total well depth in a monitoring well or piezometer.

Total well depth measurement can be performed also using an electric water level indicator. The electrical probe of the indicator should be lowered into the monitoring well until resistance is met, indicating that the probe has reached the bottom of the well. The total well depth should then be read directly from the indicator to the 0.01-foot fraction. If the monitoring well top is not flush with the ground surface, the distance between the bottom of the well and the top of the riser pipe should be measured; the height of the riser pipe above ground surface should then be subtracted from the first measurement to determine the depth from ground surface to the bottom of the well. To ensure measurement accuracy, the probe should be left hanging above the water surface in the monitoring well; a series of three readings should be taken, and the values should be averaged. The measurement date and time, individual readings, and the average of the readings should be recorded in a field logbook.

2.3 IMMISCIBLE LAYER DETECTION AND MEASUREMENT

The procedure described below should be followed to detect and measure an immiscible layer in a monitoring well.

A light immiscible layer in a monitoring well can be detected by slowly lowering an interface probe to the surface of the water in the well. When the audible alarm sounds, the depth of the probe should be recorded. If the alarm is continuous, a light immiscible layer has been detected. To measure the thickness of this layer, the probe should then be lowered until the alarm changes to an oscillating signal. The oscillating alarm indicates that the probe has reached a water layer. The probe depth at the time the alarm begins oscillating should be recorded as the depth to water. The thickness of the light immiscible layer should then be determined by subtracting the depth at which a continuous alarm occurred from the depth at which the alarm began to oscillate. To ensure measurement accuracy, the interface probe should be left hanging above the water surface in the monitoring well; a series of three readings should be taken, and the depths and thicknesses measured should be averaged. The measurement date and time, individual readings for depth and thickness, and average values for depth and thickness should be recorded in a field logbook.

To determine whether a dense immiscible layer is present, the interface probe should be lowered further into the monitoring well. If the alarm changes from an oscillating to a continuous signal, a heavier immiscible layer has been detected, and the probe depth should be recorded at that point. Total well depth obtained in Section 2.2 should be used for calculating the thickness of the dense layer. The dense layer should be calculated by subtracting the depth at which the alarm became continuous from the total well depth. This procedure provides an estimate of the thickness of the dense layer in the monitoring well. To ensure measurement accuracy, the interface probe should be left hanging above the water surface in the monitoring well; a series of three readings should be taken, and the depths and thicknesses measured should be averaged. The measurement date and time, individual readings for depth and thickness, and average values for depth and thickness should be recorded in a field logbook.

SOP 015

GROUNDWATER SAMPLE COLLECTION USING MICROPURGE TECHNOLOGY

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLE COLLECTION USING MICROPURGE TECHNOLOGY

SOP NO. 015

REVISION NO. 0

Last Reviewed: January 2000

RRiesing

Quality Assurance Approved

April 7, 1998

Date

1.0 BACKGROUND

Groundwater sample collection is an integral part of site characterization at many contaminant release investigation sites. Often, a requirement of groundwater contaminant investigation is to evaluate contaminant concentrations in the aquifer. Since data quality objectives of most investigations require a laboratory setting for chemical analysis, samples must be collected from the aquifer and submitted to a laboratory for analysis. Therefore, sample collection and handling must be conducted in a manner that minimizes alteration of chemical characteristics of the groundwater.

In the past, most sample collection techniques followed federal and state guidance. Acceptable protocol included removal of water in the casing of a monitoring well (purging), followed by sample collection. The water in the casing was removed so groundwater from the formation could flow into the casing and be available for sample collection. Sample collection was commonly completed with a bailer, bladder pump, controlled flow impeller pump, or peristaltic pump. Samples were preserved during collection. Often, samples to be analyzed for metals contamination were filtered through a 0.45-micron filter prior to preservation and placement into the sample container.

Research conducted by several investigators has demonstrated that a significant component of contaminant transport occurs while the contaminant is sorbed onto colloid particles. Colloid mobility in an aquifer is a complex, aquifer-specific transport issue, and its description is beyond the scope of this Standard Operating Procedure (SOP). However, concentrations of suspended colloids have been measured during steady state conditions and during purging activities. Investigation results indicate standard purging procedures can cause a significant increase in colloid concentrations, which in turn may bias analytical results.

Micropurge sample collection provides a method of minimizing increased colloid mobilization by removing water from the well at the screened interval at a rate that preserves or minimally disrupts steady-state flow conditions in the aquifer. During micropurge sampling, groundwater is discharged from the aquifer at a rate that the aquifer will yield without creating a cone of depression around the sampled well. Research indicates that colloid mobilization will not increase above steady-state conditions during low-flow discharge. Therefore, the collected sample is more likely to represent steady-state groundwater chemistry.

1.1 PURPOSE

The purpose of this SOP is to describe the procedures to be used to collect a groundwater sample from a well using the micropurge technology. The following sections describe the equipment to be used and the methods to be followed to promote uniform sample collection techniques by field personnel that are experienced in sample collection and handling for environmental investigations.

1.2 SCOPE

This SOP applies to groundwater sampling using the micropurge technology. It is intended to be used as an alternate SOP to the general "Groundwater Sampling" SOP (SOP No. 10) that provides guidance for the general aspects of groundwater sampling.

1.3 DEFINITIONS

Colloid: Suspended particles that range in diameter from 5 nanometers to 0.2 micrometers.

Dissolved oxygen: The ratio of the concentration or mass of oxygen in water relative to the partial pressure of gaseous oxygen above the liquid which is a function of temperature, pressure, and concentration of other solutes.

Flow-through cell: A device connected to the discharge line of a groundwater purge pump that allows regular or continuous measurement of selected parameters of the water and minimizes contact between the water and air.

pH: The negative base-10 log of the hydrogen-ion activity in moles per liter.

Reduction and oxidation potential: A numerical index of the intensity of oxidizing or reducing conditions within a system, with the hydrogen-electrode potential serving as a reference point of zero volts.

Specific conductance: The reciprocal of the resistance in ohms measured between opposite faces of a centimeter cube of aqueous solution at a specified temperature.

Turbidity: A measurement of the suspended particles in a liquid that have the ability to reflect or refract part of the visible portion of the light spectrum.

1.4 REFERENCES

Puls, R. W. and M. J. Barcelona. 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. U.S. Environmental Protection Agency. Office of Research and Development. EPA/540/S-95/504. April.

1.5 REQUIREMENTS AND RESOURCES

The following equipment is required to complete micropurge sample collection :

- Water level indicator
- Adjustable flow rate pump (bladder, piston, peristaltic, or impeller)
- Discharge flow controller
- Flow-through cell
- pH probe
- Dissolved oxygen (DO) probe
- Turbidity meter
- Oxidation and reduction (Redox or Eh) probe
- Specific conductance (SC) probe (optional)
- Temperature probe (optional)
- Meter to display data for the probes
- Calibration solutions for pH, SC, turbidity, and DO probes, as necessary
- Container of known volume for flow measurement or calibrated flow meter
- Data recording and management system

2.0 PROCEDURE

The following procedures and criteria were modified from the U. S. Environmental Protection Agency guidance titled "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" (Puls and Barcelona 1996). This reference may be consulted for a more detailed description of micropurge sampling theory.

Micropurging is most commonly accomplished with low-discharge rate pumps, such as bladder pumps, piston pumps, controlled velocity impeller pumps, or peristaltic pumps. Bailers and high capacity submersible pumps are not considered acceptable micropurge sample collection devices. The purged water is monitored (in a flow-through cell or other constituent monitoring device) for chemical and optical parameters that indicate steady state flow conditions between the sample extraction point and the aquifer. Samples are collected when steady state conditions are indicated.

Groundwater discharge equipment may be permanently installed in the monitoring well as a dedicated system, or it can be installed in each well as needed. Most investigators agree that dedicated systems will provide the best opportunity for collecting samples most representative of steady state aquifer conditions, but the scope of a particular investigation and available investigation funds will dictate equipment selection.

2.1 EQUIPMENT CALIBRATION

Prior to sample collection, the monitoring equipment used to measure pH, Eh, DO, turbidity, and SC should be calibrated or checked according to manufacturer's directions. Typically, calibration activities are completed at the field office at the beginning of sampling activities each day. The pH meter calibration should bracket the pH range of the wells to be sampled (acidic to neutral pH range [4.00 to 7.00] or neutral to basic pH range [7.00 to 10.00]). The DO meter should be calibrated to one point (air-saturated water) or two points (air-saturated water and water devoid of all oxygen). The SC meter cannot be calibrated in the field. It is checked against a known standard (typical standards are 1, 10, and 50 millimhos per centimeter at 25 □C). The offset of the measured value of the calibration standard can be used as a correction value. Similarly, the Eh probe cannot be calibrated in the field, but is checked against a known standard, such as Zobell solution. The instrument should display a millivolt (mv) value that falls within the range set by the manufacturer. Because Eh is temperature dependent, the measured value should be corrected for site-specific variance from standard temperature (25 °C). The Eh probe should be replaced if the reading is not within the manufacturer's specified range. All calibration data should be recorded on the Micropurging Groundwater Sampling Data Sheet attached to this SOP or in a logbook.

2.2 WELL PURGING

The well to be sampled should be opened and groundwater in the well allowed to equilibrate to atmospheric pressure. Equilibration should be determined by measuring depth to water below the marked reference on the wellhead (typically the top of the well casing) over two or more 5-minute intervals. Equilibrium conditions exist when the measured depth to water varies by less than 0.01 foot over two consecutive readings. Total depth of well measurement should be made following sample collection, unless the datum is required to place nondedicated sample collection equipment. Depth to water and total well depth measurements should be made in accordance with procedures outlined in SOP No. 014 (Static Water Level, Total Well Depth, and Immiscible Layer Measurement).

If the well does not have a dedicated sample collection device, a new or previously decontaminated portable sample collection device should be placed within the well. The intake of the device should be positioned at the midpoint of the well screen interval. The device should be installed slowly to minimize turbulence within the water in the casing and mixing of stagnant water above the screened interval with water in the screened interval. Following installation, the flow controller should be connected to the sample collection device and the flow-through cell connected to the outlet of the sample collection device. The calibrated groundwater chemistry monitoring probes should be installed in the flow-through cell. If a flow meter is used, it should be installed ahead of the flow-through cell.

If the well has a dedicated sample collection device, the controller for the sample collection device should be connected to the sample collection device. The flow meter and flow-through cell should be connected in line to the discharge tube, and the probes installed in the flow-through cell.

The controller should be activated and groundwater extracted (purged) from the well. The purge rate should be monitored, and should not exceed the capacity of the well. The well capacity is defined as the maximum discharge rate that can be obtained with less than 0.1 meter (0.3 foot) drawdown. Typically, the discharge rate will be less than 0.5 liters per minute (L/min) (0.13 gallons per minute). The maximum purge rate should not exceed 1 L/min (0.25 gallons per minute), and should be adjusted to achieve minimal drawdown.

Water levels, effluent chemistry, and effluent flow rate should be continuously monitored while purging the well. Purging should continue until the measured chemical and optical parameters are stable. Stable parameters are defined as monitored chemistry values that do not fluctuate by more than the following ranges over three successive readings at 3-minute intervals: ±0.1 pH unit; ±3 percent for SC; ±10 mv for Eh; and ±10 percent for turbidity and DO. Purging will continue until these stabilization criteria have been met or three well casing volumes have been purged. If three casing volumes of water have been purged and the stabilization criteria have not been met, a comment should be made on the data sheet that sample collection began after three well casing volumes were purged. The final pH, SC, Eh, turbidity, and DO values will be recorded. All data should be recorded on the Micropurging Groundwater Sampling Data Sheet attached to this SOP or in a logbook.

2.3 SAMPLE COLLECTION

Following purging, the flow through cell shall be disconnected, and groundwater samples collected directly from the discharge line. Discharge rates should be adjusted so that groundwater is dispensed into the sample container with minimal aeration of the sample. Samples collected for volatile organic compound analysis should be dispensed into the sample container at a flow rate equal to or less than 100 milliliters per minute. Samples should be preserved and handled as described in the investigation field sampling plan or quality assurance project plan.

Tetra Tech EM Inc.

MICROPURGING GROUNDWATER SAMPLING DATA SHEET

Page ____ of ____

Date ________

Well Name ____________
Project ____________
Project No. ____________
Well Location ____________
Sample Date ____________
Sampling Personnel ____________
____
Sample ID ____________
Duplicate ID ____________

Screen Interval ____________
Station Elevation ______ GND ____ TOC ____
Static Water Level (from TOC) ____________
Well Stick Up ____________
Static Elevation ____________
Well Depth ______ MEAS ____ RPTD ____
Feet of Water ____________
Gallons/Foot ____________
Casing Volume ____________

Immiscible Phases Present ☐ Yes ☐ No.
Type ____________
Measured with ____________
PID Readings (background) ____________
PID Reading (TOC) ____________
Wells Installed by ____________
Installation Date ____________
Development Date(s) ____________

FIELD CHEMISTRY CALIBRATIONS

Date/Time ____________ Spec. Conductance: Standard ______ µmhos/cm at 25°C Reading ______ µmhos/cm at ____ °C
pH: pH 4.00 - ______ at ______ °C pH 7.00 - ______ at ______ °C pH 10.00 - ______ at ______ °C Slope ______
Dissolved Oxygen: D.O. Meter ______ mg/L at ______ °C PID: Calibration Gas ______ PPM ______ Span ______ Reading ______

PURGING

Time	Discharge Rate (mL/min)	Dissolved Oxygen (mg/L)	pH	Eh/ORP (mV)	Temp. (°C)	Specific Conduct. (µmhos/cm at °C)	Turbidity (NTU)	Cumulative Volume of Water Removed (Purged)		PID/OVA Reading		Depth to Water (ft)	Comments
								Gallons	Casing Vol	Location	Value		

SAMPLE PARAMETERS

Condition of well: ____________
Remarks: ____________

FIELD EQUIPMENT

pH Meter ____________ Serial Number ____________
Spec. Cond. Meter ____________ Serial Number ____________
Pump ____________ Serial Number ____________
Water Level Meter ____________ Serial Number ____________
D.O. Meter ____________ Serial Number ____________
Filter Apparatus ____________ Filters ____________
Temperature Measure ____________
Interface Probe ____________ Serial Number ____________
PID/OVA ____________ Serial Number ____________

Field Chemistry Calibrations

Fractions ____________
____
____
Number of Bottles ____________
Sample Depth ____________
Field Notebook ____________
Sample Method ____________
____
Discharge Water Containerized ☐ Yes ☐ No

SOP 019

PACKAGING AND SHIPPING SAMPLES

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 5

Last Reviewed: January 2000

R Riesing

Quality Assurance Approved

January 28, 2000

Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. Procedures for classifying, packaging, and shipping samples are described below. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples. When hazardous substances and dangerous goods are sent by common carrier, their packaging, labeling, and shipping are regulated by the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR, *Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180) and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR).

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Sampler's Guide to the Contract Laboratory Program (CLP)," the DGR, and the HMR. Sample packaging and shipping procedures described in this SOP should be followed for all sample packaging and shipping. Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already collected in the appropriate sample jars and that the sample jars are labeled and tagged appropriately.

1.2 SCOPE

This SOP applies to sample classification, packaging, and shipping.

1.3 DEFINITIONS

Custody seal: A custody seal is a tape-like seal. Placement of the custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping.

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 1999).

Environmental samples: Environmental samples include drinking water, most groundwater and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, and biological specimens. Environmental samples typically contain low concentrations of contaminants and when handled require only limited precautionary procedures.

Hazardous Materials Regulations: The HMR are DOT regulations for the shipment of hazardous materials by air, water, and land; they are located in 49 CFR 106 through 180.

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the HMR.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in Appendix A of 49 CFR 172.101 <u>and</u> its quantity, in one package, equals or exceeds the reportable quantity (RQ) listed in the appendix.

IATA Dangerous Goods Regulations: The DGR are regulations that govern the international transport of dangerous goods by air. The DGR are based on the International Civil Aviation Organization (ICAO) Technical Instructions. The DGR contain all of the requirements of the ICAO Technical Instructions and are more restrictive in some instances.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample and **do not** need to be packaged and shipped in accordance with the DGR or HMR.

Overpack: An enclosure used by a single shipper to contain one or more packages and to form one handling unit (IATA 1999). For example, a cardboard box may be used to contain three fiberboard boxes to make handling easier and to save on shipping costs.

1.4 REFERENCES

U.S. Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (DOT and others). 1996. "1996 North American Emergency Response Guidebook."

International Air Transport Association (IATA). 1997. "Guidelines for Instructors of Dangerous Courses."

IATA. 1999. "Dangerous Goods Regulations." 40th Edition.

U.S. Environmental Protection Agency. 1996. "Sampler's Guide to the Contract Laboratory Program." Office of Solid Waste and Emergency Response. Washington, DC. EPA/540/R-96/032. On-Line Address: http://www.epa.gov/oerrpage/superfund/programs/clp/guidance.htm#sample

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping **nonhazardous** samples require the following:

- Coolers
- Ice
- Vermiculite, bubble wrap, or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)

The procedures for packaging and shipping **hazardous** samples require the following:

- Ice
- Vermiculite or other non-combustible, absorbent packing material
- Chain-of-custody forms and seals
- Appropriate dangerous goods airbills and emergency response information to attach to the airbill

- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Appropriate shipping containers as specified in the DGR
- Labels that apply to the shipment such as hazard labels, address labels, "Cargo Aircraft Only" labels, and package orientation labels (up arrows)

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and hazardous samples.

2.1 SAMPLE CLASSIFICATION

Prior to sample shipment, it must be determined whether the sample is subject to the DGR. Samples subject to these regulations shall be referred to as hazardous samples. If the hazardous sample is to be shipped by air, then the DGR should be followed. Any airline, including FedEx, belonging to IATA must follow the DGR. As a result, FedEx **may not** accept a shipment that is packaged and labeled in accordance with the HMR (although in most cases, the packaging and labeling would be the same for either set of regulations). The HMR states that a hazardous material may be transported by aircraft in accordance with the ICAO Technical Instruction (49 CFR 171.11) upon which the DGR is based. Therefore, the use of the DGR for samples to be shipped by air complies with the HMR, but not vice versa.

Most environmental samples are not hazardous samples and do not need to be packaged in accordance with any regulations. Hazardous samples are those samples that can be classified as specified in Section 3 of the DGR, can be found in the List of Dangerous Goods in the DGR in bold type, are considered a hazardous substance (see definition), or are mentioned in "Section 2 - Limitations" of the DGR for countries of transport or airlines (such as FedEx). The hazard classifications specified in the DGR (and the HMR) are as follows:

Class 1 - Explosives

Division 1.1 - Articles and substances having a mass explosion hazard

Division 1.2 - Articles and substances having a projection hazard but not a mass explosion hazard
Division 1.3 - Articles and substances having a fire hazard, a minor blast hazard and/or a minor projection hazard but not a mass explosion hazard
Division 1.4 - Articles and substances presenting no significant hazard
Division 1.5 - Very sensitive substances mass explosion hazard
Division 1.6 - Extremely insensitive articles which do not have a mass explosion hazard

Class 2 - Gases

Division 2.1 - Flammable gas
Division 2.2 - Non-flammable, non-toxic gas
Division 2.3 - Toxic gas

Class 3 - Flammable Liquids

Class 4 - Flammable Solids; Substances Liable to Spontaneous Combustion; Substances, which, in Contact with Water, Emit Flammable Gases

Division 4.1 - Flammable solids.
Division 4.2 - Substances liable to spontaneous combustion.
Division 4.3 - Substances, which, in contact with water, emit flammable gases.

Class 5 - Oxidizing Substances and Organic Peroxide

Division 5.1 - Oxidizers.
Division 5.2 - Organic peroxides.

Class 6 - Toxic and Infectious Substances

Division 6.1 - Toxic substances.
Division 6.2 - Infectious substances.

Class 7 - Radioactive Material

Class 8 - Corrosives

Class 9 - Miscellaneous Dangerous Goods

The criteria for each of the first eight classes are very specific and are outlined in Section 3 of the DGR and 49 CFR 173 of the HMR. Some classes and divisions are further divided into packing groups based on their level of danger. Packing group I indicates a great danger, packing group II indicates a medium danger, and packing group III indicates a minor danger. Class 2, gases, includes any compressed gas being shipped and any noncompressed gas that is either flammable or toxic. A compressed gas is defined as having a pressure over 40 pounds per square inch (psi) absolute (25 psi gauge). Most air samples and empty cylinders that did not contain a flammable or toxic gas are exempt from the regulations. An empty hydrogen cylinder, as in a flame ionization detector (FID), is considered a dangerous good unless it is properly purged with nitrogen in accordance with the HMR. A landfill gas sample is usually considered a flammable gas because it may contain a high percentage of methane. Class 3, flammable liquids, are based on the boiling point and flash point of a substance. Most class 3 samples include solvents, oil, gas, or paint-related material collected from drums, tanks, or pits. Division 6.1, toxic substances, is based on oral toxicity (LD_{50} [lethal dose that kills 50 percent of the test animals]), dermal toxicity (LD_{50} values), and inhalation toxicity (LC_{50} [lethal concentration that kills 50 percent of the test animals] values). Division 6.1 substances include pesticides and cyanide. Class 7, radioactive material, is defined as any article or substance with a specific activity greater than 70 kiloBecquerels (kBq/kg) (0.002 [microCuries per gram [µCi/g]). If the specific activity exceeds this level, the sample should be shipped in accordance with Section 10 of the DGR. Class 8, corrosives, are based on the rate at which a substance destroys skin tissue or corrodes steel; they are not based on pH. Class 8 materials include the concentrated acids used to preserve water samples. Preserved water samples are not considered class 8 substances and should be packaged as nonhazardous samples. Class 9, miscellaneous dangerous goods, are substances that present a danger but are not covered by any other hazard class. Examples of class 9 substances include asbestos, polychlorinated biphenyls (PCB), and dry ice.

Unlike the DGR, the HMR includes combustible liquids in hazard class 3. The definition of a combustible liquid is specified in 49 CFR 173.120 of the HMR. The HMR has an additional class, ORM-D, that is not specified in the DGR. "ORM-D material" refers to a material such as a consumer commodity, that although otherwise subject to the HMR, presents a limited hazard during transport due to its form, quantity, and packaging. It must be a material for which exceptions are provided in the table of 49 CFR 172.101. The DGR lists consumer commodities as a class 9 material.

In most instances, the hazard of a material sampled is unknown because no laboratory testing has been conducted. A determination as to the suspected hazard of the sample must be made using knowledge of the site, field observations, field tests, and other available information.

According to 40 CFR 261.4(d) and (e), samples transported to a laboratory for testing or treatability studies, including samples of hazardous wastes, are **not** hazardous wastes. FedEx will not accept a shipment of hazardous waste.

2.2 PACKAGING NONHAZARDOUS SAMPLES

Nonhazardous samples, after being appropriately containerized, labeled, and tagged, should be packaged in the following manner. Note that these are general instructions; samplers should be aware of any client-specific requirements concerning the placement of custody seals or other packaging provisions.

1. Place the sample in a resealable plastic bag.

2. Place the bagged sample in a cooler and pack it to prevent breakage.

3. Prevent breakage of bottles during shipment by either wrapping the sample container in bubble wrap, or lining the cooler with a noncombustible material such as vermiculite. Vermiculite is especially recommended because it will absorb any free liquids inside the cooler. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.

4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. As an option, a temperature blank (a sample bottle filled with distilled water) can be included with the cooler.

5. Seal the completed chain-of-custody forms in a plastic bag and tape the plastic bag to the inside of the cooler lid.

6. Tape any instructions for returning the cooler to the inside of the lid.

7. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once. Tape shut any drain plugs on the cooler.

8. Place two signed custody seals on the cooler, ensuring that each one covers the cooler lid and side of the cooler. Place clear plastic tape over the custody seals.

9. Place address labels on the outside of the cooler.

10. Ship samples overnight by a commercial carrier such as FedEx.

2.3 PACKAGING HAZARDOUS SAMPLES

The procedures for packaging hazardous samples are summarized below. Note that according to the DGR, all spellings must be exactly as they appear in the List of Dangerous Goods, and only approved abbreviations are acceptable. The corresponding HMR regulations are provided in parentheses following any DGR referrals. The HMR must be followed only if shipping hazardous samples by ground transport.

1. Determine the proper shipping name for the material to be shipped. All proper shipping names are listed in column B of the List of Dangerous Goods table in Section 4 of the DGR (or column 2 of the Hazardous Materials Table in 49 CFR 172.101). In most instances, a generic name based on the hazard class of the material is appropriate. For example, a sample of an oily liquid collected from a drum with a high photoionization detector (PID) reading should be packaged as a flammable liquid. The proper shipping name chosen for this sample would be "flammable liquid, n.o.s." The abbreviation "n.o.s." stands for "not otherwise specified" and is used for generic shipping names. Typically, a specific name, such as acetone, should be inserted in parentheses after most n.o.s. descriptions. However, a technical name is not required when shipping a sample for testing purposes and the components are not known. If shipping a hazardous substance (see definition), then the letters "RQ" must appear in front of the proper shipping name.

2. Determine the United Nations (UN) identification number, class or division, subsidiary risk if any, required hazard labels, packing group, and either passenger aircraft or cargo aircraft packing instructions based on the quantity of material being shipped in one package. This information is provided in the List of Dangerous Goods (or Hazardous Materials Table in 49 CFR 172.101) under the appropriate proper shipping name. A "Y" in front of a packing instruction indicates a limited quantity packing instruction. If shipping dry ice or a limited quantity of a material, then UN specification shipping containers do not need to be used.

3. Determine the proper packaging required for shipping the samples. Except for limited quantity shipments and dry ice, these are UN specification packages that have been tested to meet the packing group of the material being shipped. Specific testing requirements of the packages is listed in Section 6 of the DGR (or 49 CFR 178 of the HMR). All UN packages are stamped with the appropriate UN specification marking. Prior planning is required to have the appropriate packages on hand during a sampling event where hazardous samples are anticipated. Most samples can be shipped in either a 4G fiberboard box, a 1A2 steel drum, or a 1H2 plastic drum. Drums can be purchased in 5- and 20-gallon sizes and are ideal for shipping multiple hazardous samples. When FedEx is used to ship samples containing PCBs, the samples must be shipped in an inner metal packaging (paint can) inside a 1A2 outer steel drum. This method of packaging PCB samples is in accordance with FedEx variation FX-06, listed in Section 2 of the DGR.

4. Place each sample jar in a separate resealable plastic bag. Some UN specification packagings contain the sample jar and plastic bag to be used when shipping the sample.

5. Place each sealed bag inside the approved UN specification container (or other appropriate container if a limited quantity or dry ice) and pack with enough noncombustible, absorbent, cushioning material (such as vermiculite) to prevent breakage and to absorp liquid.

6. Place chain-of-custody forms in a resealable plastic bag and either attach it to the inside lid of the container or place it on top inside the container. Place instructions for returning the container to the shipper on the inside lid of the container as appropriate. Close and seal the shipping container in the manner appropriate for the type of container being used.

7. Label and mark each package appropriately. All irrelevant markings and labels need to be removed or obliterated. All outer packagings must be marked with proper shipping name, UN identification number, and name and address of the shipper and the recipient. For carbon dioxide, solid (dry ice), the net weight of the dry ice within the package needs to be marked on the outer package. For limited quantity shipments, the words "limited quantity" or "LTD. QTY." must be marked on the outer package. Affix the appropriate hazard label to the outer package. If the material being shipped contains a subsidiary hazard, then a subsidiary hazard label must also be affixed to the outer package. The subsidiary hazard label is identical to the primary hazard label except that the class or division number is not present. It is acceptable to obliterate the class or division marking on a primary hazard label and use it as the subsidiary hazard label. If using cargo aircraft only packing instructions, then the "Cargo Aircraft Only" label must be used. Package orientation labels (up arrows) must be placed on opposite sides of the outer package. Figure 1 depicts a properly marked and labeled package.

8. If using an overpack (see definition), mark and label the overpack and each outer packaging within the overpack as described in step 7. In addition, the statement "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS" must be marked on the overpack.

9. Attach custody seals, and fill out the appropriate shipping papers as described in Section 2.4.

2.4 SHIPPING PAPERS FOR HAZARDOUS SAMPLES

A "Shippers Declaration for Dangerous Goods" and "Air Waybill" must be completed for each shipment of hazardous samples. FedEx supplies a Dangerous Goods Airbill to its customers; the airbill combines both the declaration and the waybill. An example of a completed Dangerous Goods Airbill is depicted in Figure 2. A shipper's declaration must contain the following:

- Name and address of shipper and recipient
- Air waybill number (not applicable to the HMR)
- Page ___ of ___
- Deletion of either "Passenger and Cargo Aircraft" or "Cargo Aircraft Only," whichever does not apply
- Airport or city of departure
- Airport or city of destination
- Deletion of either "Non-Radioactive" or "Radioactive," which ever does not apply
- The nature and quantity of dangerous goods. This includes the following information in the following order (obtained from the List of Dangerous Goods in the DGR): proper shipping name, class or division number, UN identification number, packing group number, subsidiary risk, quantity in liters or kilograms (kg), type of packaging used, packing instructions, authorizations, and additional handling information. Authorizations include the words "limited quantity" or "LTD. QTY." if shipping a limited quantity, any special provision numbers listed in the List of Dangerous Goods in the DGR, and the variation "USG-14" when a technical name is required after the proper shipping name but not entered because it is unknown.
- Signature for the certification statement
- Name and title of signatory
- Place and date of signing certification
- A 24-hour emergency response telephone number for use in the event of an incident involving the dangerous good
- Emergency response information attached to the shipper's declaration. This information can be in the form of a material safety data sheet or the applicable North American Emergency Response Guidebook (NAERG; DOT 1996) pages. Figure 3 depicts the appropriate NAERG emergency response information for "Flammable liquids, n.o.s." as an example.

Note that dry ice does not require an attached shipper's declaration. However, the air waybill must include the following on it: "Dry ice, 9, UN1845, ____ x ____ kg." The blanks must include the number of packages and the quantity in kg in each package. If using FedEx to ship dry ice, the air waybill includes a box specifically for dry ice. Simply check the appropriate box and enter in the number of packages and quantity in each package.

The HMR requirements for shipping papers are located in 49 CFR 172 Subpart C.

3.0 POTENTIAL PROBLEMS

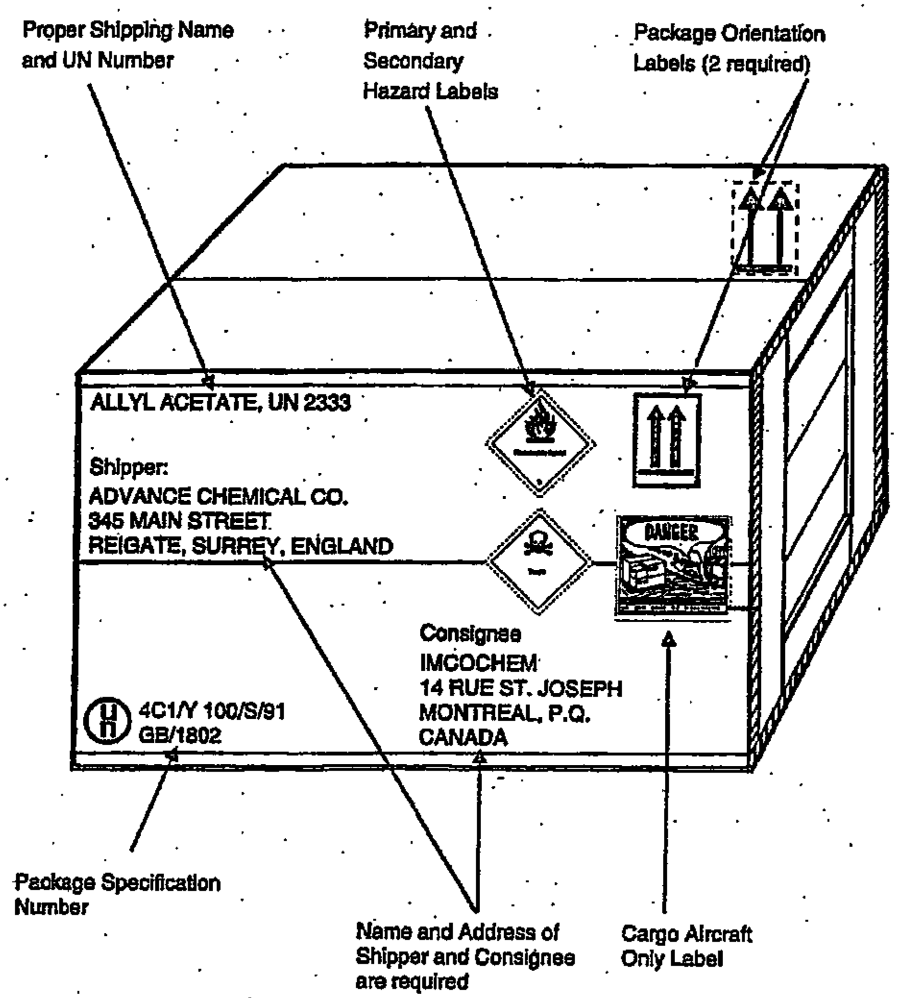
The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks, the carrier may open the package, return the package, and if a dangerous good, inform the Federal Aviation Administration (FAA), which can result in fines.
- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment.
- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice this as well and return the package to the shipper.

Contact FedEx with questions about dangerous goods shipments by calling 1-800-463-3339 and asking for a dangerous goods expert.

FIGURE 1

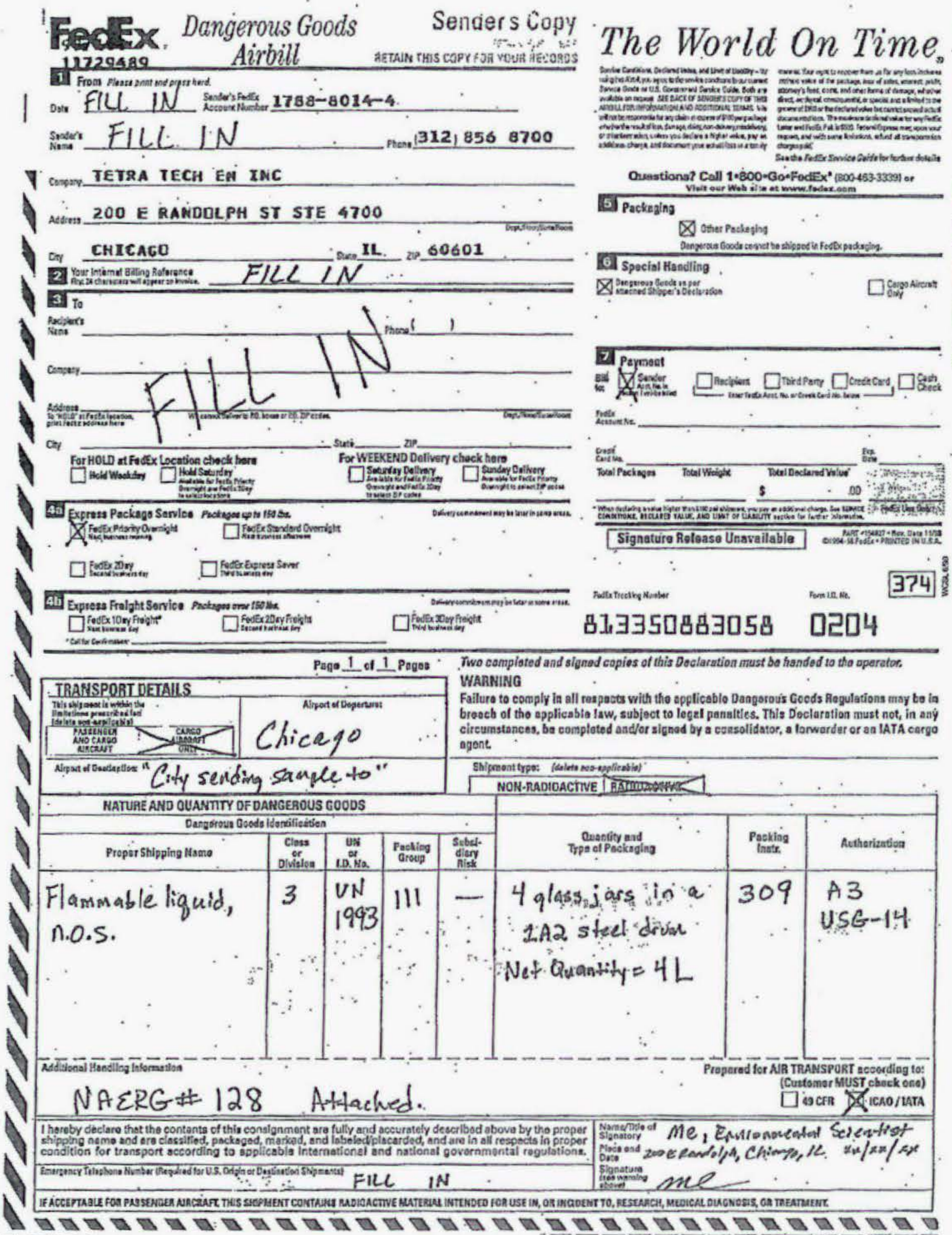
EXAMPLE OF A CORRECTLY MARKED AND LABELED DANGEROUS GOODS PACKAGE



Source: International Air Transport Association (IATA). 1997.

FIGURE 2

EXAMPLE OF A DANGEROUS GOODS AIRBILL



FedEx Dangerous Goods Airbill — Sender's Copy — RETAIN THIS COPY FOR YOUR RECORDS — The World On Time.

11729489

1 From — Date: FILL IN — Sender's FedEx Account Number: 1788-8014-4
Sender's Name: FILL IN — Phone: (312) 856 8700
Company: TETRA TECH EM INC
Address: 200 E RANDOLPH ST STE 4700
City: CHICAGO — State: IL — ZIP: 60601

2 Your Internal Billing Reference: FILL IN

3 To — Recipient's Name / Phone / Company / Address / City / State / ZIP: FILL IN

For HOLD at FedEx Location check here: Hold Weekday / Hold Saturday
For WEEKEND Delivery check here: Saturday Delivery / Sunday Delivery

4a Express Package Service: [X] FedEx Priority Overnight / FedEx Standard Overnight / FedEx 2Day / FedEx Express Saver

4b Express Freight Service: FedEx 1Day Freight / FedEx 2Day Freight / FedEx 3Day Freight

Questions? Call 1·800·Go·FedEx® (800-463-3339) or Visit our Web site at www.fedex.com

5 Packaging: [X] Other Packaging — Dangerous Goods cannot be shipped in FedEx packaging.

6 Special Handling: [X] Dangerous Goods as per attached Shipper's Declaration — Cargo Aircraft Only

7 Payment — Bill to: [X] Sender / Recipient / Third Party / Credit Card / Cash/Check

Total Packages — Total Weight — Total Declared Value $ .00

Signature Release Unavailable

374

FedEx Tracking Number: 813350883058 — Form I.D. No. 0204

Page 1 of 1 Pages

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS — This shipment is within the limitations prescribed for: (delete non-applicable) PASSENGER AND CARGO AIRCRAFT / CARGO AIRCRAFT ONLY

Airport of Departure: Chicago

Airport of Destination: "City sending sample to"

Shipment type: (delete non-applicable) NON-RADIOACTIVE / ~~RADIOACTIVE~~

NATURE AND QUANTITY OF DANGEROUS GOODS

Proper Shipping Name	Class or Division	UN or I.D. No.	Packing Group	Subsidiary Risk	Quantity and Type of Packaging	Packing Instr.	Authorization
Flammable liquid, n.o.s.	3	UN 1993	III	—	4 glass jars in a 1A2 steel drum Net Quantity = 4L	309	A3 USG-14

Additional Handling Information: NAERG # 128 Attached.

Prepared for AIR TRANSPORT according to: (Customer MUST check one) 49 CFR / [X] ICAO/IATA

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked, and labeled/placarded, and are in all respects in proper condition for transport according to applicable International and national governmental regulations.

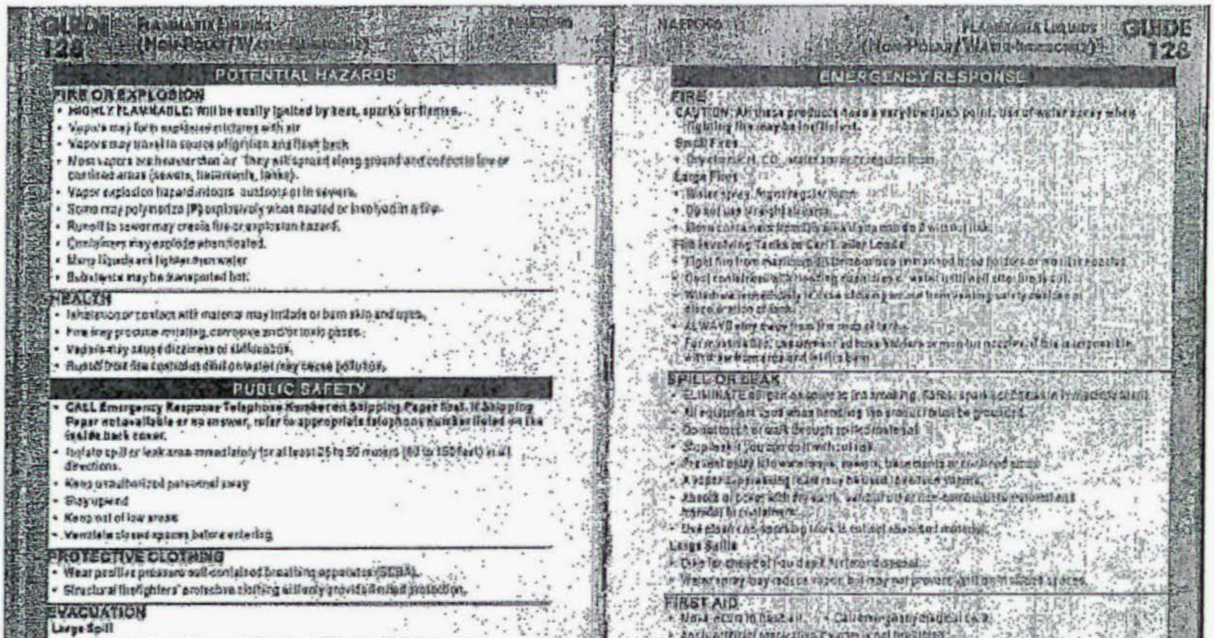
Name/Title of Signatory: Me, Environmental Scientist
Place and Date: 200 E Randolph, Chicago, IL. xx/xx/xx
Signature: me

Emergency Telephone Number (Required for U.S. Origin or Destination Shipments): FILL IN

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

FIGURE 3

NAERG EMERGENCY RESPONSE INFORMATION FOR FLAMMABLE LIQUIDS, N.O.S.



Source: DOT and others. 1996.

SOP 024

RECORDING OF NOTES IN FIELD LOGBOOK

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING OF NOTES IN FIELD LOGBOOK

SOP NO. 024

REVISION NO. 1

Last Reviewed: November 1999

K Riesing

Quality Assurance Approved

May 18, 1993

Date

1.0 BACKGROUND

The field logbook should contain detailed records of all the field activities, interviews of people, and observations of conditions at a site. Entries should be described in as much detail as possible, so that personnel can accurately reconstruct the activities and events which have taken place during field assignments. Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate, detailed, and reflect the importance of the field events.

1.1 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide guidance to ensure that logbook documentation for any field activity is correct, complete, and adequate. Logbooks are used for identifying, locating, labeling, and tracking samples. A logbook should document any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel. They also serve as documentation of any photographs taken during the course of the project. In addition, the data recorded in the logbook may assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining good quality control. Quality control is enhanced by the proper documentation of all observations, activities, and decisions.

1.2 SCOPE

This SOP establishes the general requirements and procedures for recording notes in the field logbook.

1.3 DEFINITIONS

None

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field.* John Wiley and Sons. New York, N.Y.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Field logbooks
- Ballpoint pens with permanent ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water resistant and acid-proof covers; they should have preprinted lines and wide columns. They should be approximately 7 1/2 by 4 1/2 inches or 8 1/2 by 11 inches in size. Loose-leaf sheets are not acceptable for field notes. If notes are taken on loose paper, they must be transcribed as soon as possible into a regular field logbook by the same person who took the notes.

Logbooks can be obtained through the Document Control Administrator (DCA) for each office. The DCA will have assigned each logbook an identification number. The DCA will make sure the pages in the logbooks are preprinted with consecutive numbers or are consecutively numbered by hand. If the numbers are written by hand, then numbers should be circled so that they are not confused with data.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites, designate a separate logbook for each subsite. For special tasks, such as periodic well water-level measurements, data from multiple subsites may be entered into one logbook which contains only one type of information.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed from the logbook for any purpose.

- All field activities, meetings, photographs, and names of personnel must be recorded in the site logbook.

- All logbooks pertaining to a site or subsite should be assigned a serial number based on the date the logbook is issued to the project manager. The first logbook should be assigned number 1, the next logbook issued assigned number 2, and so on. The project manager is to maintain a record of all logbooks issued under the project.

- All information must be entered with a ballpoint pen with waterproof ink. Do not use pens with "wet ink," because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.

- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective.

- Begin a new page for each day's notes.

- Write notes on every line of the logbook. If a subject changes and an additional blank space is necessary to make the new subject title standout, skip one line before beginning the new subject. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.

- Draw a diagonal line on any blank spaces of four lines or more to prevent unauthorized entries.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent with other field logbooks. Guidelines for the cover, spine, and internal pagination are discussed below.

2.2.1 FORMAT OF FIELD LOGBOOK COVER AND SPINE

Write the following information in clear capital letters on the front cover of each logbook.

- Logbook identification number (assigned by the DCA)

- The serial number of the logbook (assigned by the project manager)

- Name of the site, city, and state

- Name of subsite if applicable
- Type of activity
- Beginning and ending dates of activities entered into the logbook
- "Tetra Tech EM Inc." City and State
- "REWARD IF FOUND"

Some of the information listed above, such as the list of activities and ending dates, should be entered after the entire logbook has been filled or after it has been decided that the remaining blank pages in the logbook will not be filled.

The spine of the logbook should contain an abbreviated version of the information on the cover. For example: "1, Col. Ave., Hastings, 5/88 - 8/88."

2.2.2 First Page of the Field Logbook

Spaces are usually provided on the inside front cover (or the opening page in some logbooks), for the company name ("Tetra Tech EM Inc."), address, and telephone number. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page.

2.3 ENTERING INFORMATION IN THE LOGBOOK

Enter the following information at the beginning of each day or whenever warranted during the course of a day:

- Date
- Starting time
- Specific location
- General weather conditions and approximate temperature

- Names of personnel present at the site. Note the affiliation(s) and designation(s) of all personnel.
- Equipment calibration and equipment models used.
- Changes in instructions or activities at the site.
- Levels of personal protective clothing and equipment.
- A general title of the first task undertaken (for example, well installation at MW-11, decon at borehole BH-11, groundwater sampling at MW-11).
- Provide an approximate scale for all diagrams. If this can't be done, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections. Label features on each diagram.
- Corrections should be made by drawing a single line through the entry being corrected. Initial and date any corrections made in the logbook.
- The person recording notes is to initial each page after the last entry. No information will be entered in the area following these initials.
- At the end of the day, the person recording notes is to sign and date the bottom of the last page. Indicate the end of the work day by writing "Left site at (time)." A diagonal line will be drawn across any blank space to the bottom of the page.

The following information should be recorded in the logbook after taking a photograph:

- Time, date, location, direction, and if appropriate, weather conditions
- Description of the subject photographed and the reason for taking the picture
- Sequential number of the photograph and the film roll number (if applicable)
- Name of the photographer

The following information should be entered into the logbook when taking samples:

- Location description
- Names of samplers
- Collection time
- Designation of samples as a grab or composite sample
- Type of sample (water, sediment, soil gas, etc.)

- On-site measurement data (pH, temperature, specific conductivity)
- Field observations (odors, colors, weather, etc.)
- Preliminary sample description
- Type of preservative used
- Instrument readings

2.4 PRECAUTIONS

Custody of field logbooks must be maintained at all times. Field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. Logbooks are official project documents and must be treated as such.

SOP 1134 (REVISION 6)
WATER SAMPLING PROCEDURES

Standard Operating Procedure (SOP)
For
Water Sample Collection, Preservation, Documentation and Shipping; Sonde Deployment and Continuous Monitoring

Louisiana Department of Environmental Quality
Office of Environmental Compliance
Surveillance Division

Revision 6

Approved by: ______________________________ Date: ______________
David Oge', OEC Surveillance Division

Document Owner: Kevin Masden, OEC Surveillance Division

Please Note: The official version of this document is maintained on the LDEQ Intranet. Copies, whether in electronic or printed form, are not official and should be verified as current against the official document on the Intranet. The Control Header of the SOP will be used in comparison to the official document.

Document Review and Revision Record

Note: Actions older than 5 years may be removed from this record

Approval Date	Revision No.	Record of Activity
8/23/2000	0	Initial version of this SOP approved.
2/22/2001	1	Minor changes to sampling procedures.
5/22/2001	2	Minor changes to sampling procedures. Attached forms updated.
6/24/2002	3	Minor changes; attached forms updated.
3/23/2004	4	Document updated for NPDES delegation package in the Introduction, Section 4.2 and Section 8.2.
4/2/2008	5	Added revised Water Quality Sample Record Form (Attachment 6); added use of sonde's for water quality data collection; added procedures related to use of continuous monitors. Updated Sample Containers, Preservation Techniques & Holding Times (Attachment 2).
1/5/2010	6	Major changes to Laboratory and Data Management procedures.

Table of Contents

Attachments

1 Water Sampling Devices

2 Bottles Labeling

3 Sample Numbering Format

4 Compliance Monitoring Team Effort Record Form

1.0 Purpose/Applicability

Consistent, accurate measurements of the water quality components of ambient waters of the state and discharges to those waters are a primary function of the Surveillance Division of the Office of Environmental Compliance (OEC). Proper collection, preservation, documentation, and shipping make up the process by which these measurements are made. It is important that everyone involved in the effort performs and applies this process correctly and consistently.

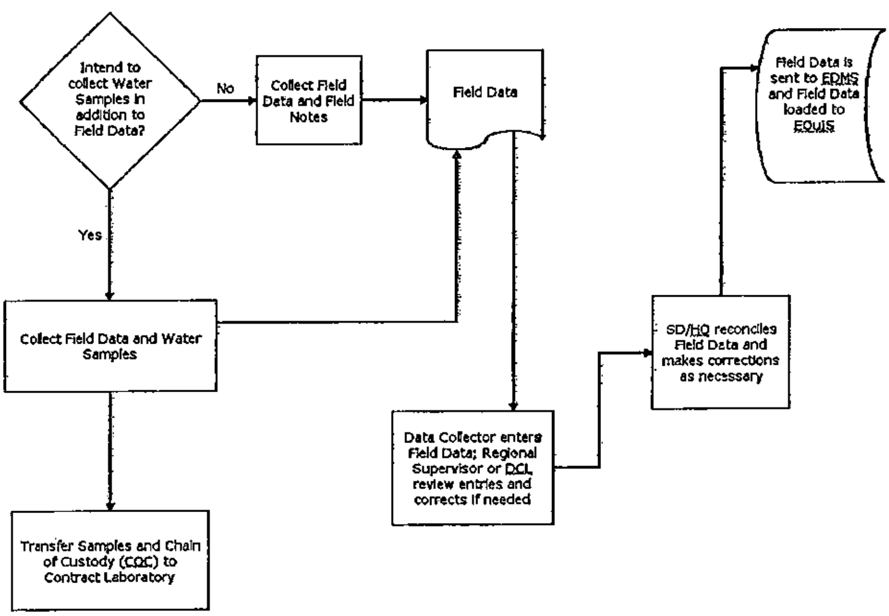
This document is applicable to all activities conducted by the DEQ/OEC/Surveillance Division relative to water sampling. Surveillance efforts that may require collection of water samples are as follows:

a. permitted discharge compliance determinations
b. complaint Investigations
c. aquatic mortality investigations
d. ambient water quality monitoring
e. unpermitted discharges/spill investigations
f. specific water quality projects

A common use of the information that is gathered by the water sampling process is the assessment of ambient water quality in rivers, lakes, and streams. These data can provide indications of problems with land usage, municipalities, industries, or demonstrate naturally occurring conditions. Accurate and reliable water quality measurements are essential to effective water quality management.

2.0 Description of Process

The following flow chart is an overview of the sampling process:



2.1 Water Sample Collection Methods

The method of water sampling is dependent upon the analyte, the environment from which the sample is collected and what the sample is intended to represent. The intent is the collection of an uncontaminated and representative sample that is placed in a proper clean container with the prescribed preservative. Samples can either be collected by hand or by one of various devices made specifically for that purpose. In either case, preventing contamination of the sample and preserving it properly are of paramount importance.

2.1.1 Hand Sampling

The simplest method of water sampling is hand sampling. Hand sampling is most applicable in turbulent flowing shallow streams, ditches, pipe discharges, flume or weir discharges; or when the specific parameter so requires (*i.e.* oil and grease). This type of sampling is acceptable when stratified samples within the water column are not needed or when homogeneity of the water is present (the water column is well-mixed). The following provide general details of the method.

- Gloves should be worn that are waterproof and appropriate for the situation. For instance, when collecting for trace metals in the ambient condition, wear gloves that are non-talc (to prevent contamination) and constructed from polyethylene, latex, vinyl, or PVC. When collection samples of a spilled substance, use gloves that are consistent with Personal Protective Equipment requirements.
- Fill the sample container directly with a representative sample from the water body.
  a. Immerse or partially immerse a clean sample container into the water being sampled.
  b. Allow gravity or displacement to fill the container.
  c. Remove as much air as possible, leaving little or no "head space" (check for parameter specific requirements).
- Fill the sample container indirectly with a representative sample from the water body.
  a. Use an intermediate sample container such as a beaker (if clean), rinsed (with water from the water body being sampled), and of acceptable construction.
  b. Pour any rinsate downstream from the sampling location.
  c. Transfer the sample from the intermediate sample container to the final, clean container.
  d. Remove as much air as possible, leaving little or no "head space" (check for parameter specific requirements).
- Prepare the sample for delivery to the appropriate laboratory, including necessary packing (to prevent breakage) and chilling (per sample preservation requirements).
- Deliver or ship the sample.

- Refer to following sections for specifics concerning the collection, handling, QC techniques, etc. of certain analytes.

2.1.2 Sampling with Devices

If hand sampling is not appropriate, collect samples by using a sampling device. Some devices, due to their design and materials, are suitable to collect samples only for specific analytes. There are a great variety of devices that have been manufactured specifically for the sampling of water. A common device is the Kemerrer (see Attachment 1). These samplers remain open to the water column until triggered by a messenger sent from the operator. This allows one to collect discreet samples from various depths in a body of water. Water collected from each depth can be transferred from the device into a container suitable for compositing (large enough to contain numerous aliquots) or individually into a sample bottle or jar (grab sample). LDEQ Surveil ance personnel frequently use a sampling device called the wastewater or sewage sampler (see Attachment 1). This sampling device is a stainless steel cylinder with a screw-on top. The screw-on top consists of a stainless steel stirrup and two tubes. The stirrup enables the attachment of a rope or other apparatus for lowering and raising the sampler from the water body. One of the tubes allows for the entry of water. This tube descends into the sampler nearly one-half the depth of the cylinder. The other tube allows displaced air to escape. The inside, bottom of the cylinder contains a holder for dissolved oxygen bottles. The design of the wastewater sampler prevents aeration of samples and provides a sample suitable for analyses of dissolved gases (e.g., dissolved oxygen, volatile organics). However, this device will not collect discreet depth samples without modification as the device begins collecting water as soon as it is lowered into the water body. The following provide general details of the method for using sampling devices.

- Gloves should be worn that are waterproof and appropriate for the requested analysis.
- Rinse sampler with water from the water body to be sampled.
  a. Lower the sampler to desired depth.
  b. Allow sampler to fill with water.
  c. Dispose of the water (rinsate) downstream from the sampling point.
- Lower the sampler to the desired depth.
- Allow the sampler to fill with water and trip the sending unit to allow the device to close, if applicable.
- Distribute sample to appropriate sample containers. Continue to lower the sampler to the desired depth and distribute sample to appropriate sample containers until all sample containers are filled.
- Prepare samples for delivery or shipment to the appropriate Laboratory.
- Ship or deliver samples.
- Refer to the remaining portions of the SOP for specifics concerning sample handling, shipping, QC, etc.

3.0 Quality Control Procedures

Periodic and systematic confirmation of sample quality is necessary to establish confidence in data generated by Surveillance personnel. In addition to procedures that provide for the cleaning and decontamination of containers and samplers, other measures must be taken to demonstrate satisfactory sampling practices, uncontaminated reagents, containers, or other avenues of sample degradation.

3.1 Samples

Quality Control (QC) samples are submitted to the Laboratory for analysis and the results are utilized to ensure sample integrity. The samples are delivered along with samples collected with WQN, surveys, etc. Equipment blanks are the typical QC samples submitted by surveillance personnel.

3.2 Equipment Blank Samples

Equipment blank is a sample that consists of a clean sample container filled in the field with an unopened one gallon container of distilled water. This distilled water can be purchased for a local source in your region. If you have access to deionized or ultrapure water in your region this can be substituted provided that proper procedures are taken to avoid contamination of this water. Collect the equipment blank immediately prior to collection of first sample. Site number 0000 should be used as the site number for all equipment blank samples. Also, use the same method, including preservation, for collecting the equipment blank that is used for the water body sample. For instance, if a wastewater sampler is utilized to collect the sample then the water is poured into the same wastewater sampler prior to placing in the designated sample container. If an intermediate sample container is utilized to transfer the sample, pour the water into the intermediate sample container prior to the designated sample container. This type sample identifies any contaminating influences from the field sampling environment and equipment. Refer to Section 6 and attachment 3 for additional details concerning sample numbering. Collect and submit for analysis at least one equipment blank per "major" compliance effort when appropriate (that is, when sampling equipment is used). Collect and submit equipment blank samples during an ambient water quality effort per the Quality Assurance Project Plan for the Ambient Water Quality Monitoring Network, or when contamination problems are suspected.

3.3 Sample Containers

Using the appropriate sample container is very important to ensure the quality of data. A variety of containers are used depending upon the parameters. The sample containers used by the Surveillance personnel are received in <u>certified clean</u> condition from the Contract Laboratory. Use only containers that are Certified Clean. Further cleaning is not necessary or recommended. Discard any suspect sample container. Keep lids tightly closed and store the containers in such a way as to prevent contamination. Do not reuse sample containers under any circumstance. Guidelines outlining the sample container size for selected parameters can be found (see <u>http://intranet/innerweb/Surveillance/WaterQuality/AmbientWaterQualityForms/tabid/100/Default.aspx</u>. If you need additional information concerning sample containers send questions to (deqlabinfo@la.gov).

3.4 Cleaning and Decontamination of Sampling Devices

Ensuring that samples arrive at the Laboratory free from contamination is of paramount importance to the success of a sampling effort. The integrity of a sample is immediately compromised if the sampling device or sample container is contaminated. If contamination exists, the effort to collect the sample, the analysis, and the data produced are rendered worthless. Eliminate possible contamination by following the appropriate cleaning and decontamination procedures.

a. Thoroughly wash all sampling devices and appropriate containers inside and out with phosphate free detergent. (Do not wash containers that are received in Certified Clean condition.)
b. Rinse at least three times with distilled or ultrapure water.
c. Repeat steps a and b until the device or container is clean.
d. In the case of organics or pesticides (ABN) sampling, rinse the devices with nanograde solvent (the same solvent(s) used in the method-specific extraction process) as a final rinse.
e. Store and transport sampling devices and containers in such a way as to prevent contamination. A portable airtight container is ideal for this purpose. Only a clean sampler or containers should ever be placed into the airtight carrier. If re-usable airtight containers are used, the containers must receive cleaning per steps a, b and c periodically.
f. After a sampling effort has been completed, clean sampling devices by following steps a, b, and c.

4.0 Water Sampling Procedures

The method of water sampling depends upon several factors. These include the type of samples required and the environment to be sampled. Two main categories of sampling conducted by Surveillance personnel are ambient and compliance sampling.

Ambient sampling involves the collection of surface water from lakes, streams, bayous, creeks, etc. These samples are collected primarily for the purpose of characterizing water quality for the water quality assessment process described in the Quality Assurance Project Plan for the Ambient Water Quality Monitoring Network (AWQMN), where the majority of ambient samples are collected. Sampling methods, procedures, and techniques associated with the AWQMN are dictated by the project QAPP.

Ambient water samples are also collected in conjunction with specific projects, citizen complaints, unpermitted discharges/spills, and aquatic mortalities. Investigations pursuant to citizens' complaints, unpermitted discharges/spills, aquatic mortalities, etc, need any available information (clues) to guide the investigator concerning the type of samples to collect for incident cause determination. Professional judgment based upon available information must be utilized in investigations. Perform *in situ* profiling of the water body (DO, temperature, conductivity, and pH) and obtain information concerning point and nonpoint source influences in the area. Use the information as a guide for sampling. Always wear appropriate PPE when collecting samples.

Due to the low levels of metals found in ambient conditions, specific techniques and methods may be needed to detect and quantify metals in ambient surface waters. Section 4.3.4.2 contains a description of a modified clean technique employed for the purposes of the Ambient Water Quality Monitoring Network.

Compliance sampling involves collecting samples from facilities or ambient waters influenced directly by a facility or other anthropogenic source. The primary purpose of compliance sampling is to determine the quality of a particular effluent as compared to the parameter-specific levels authorized in an LPDES permit. Use the permit to determine parameters concerning sampling. The permit specifies analyses, sampling point, etc. However, the inspector conducting the Compliance Sampling Inspection (CSI) can collect samples for any parameter desired, even if not described in the permit. Although the results of samples for parameters not present in a permit may or may not be used for enforcement proceedings, they can be used for enforcement, permit-modifying activities, or for determining sources of a particular ambient condition being investigated.

4.1 Ambient Sampling

The primary purpose of ambient water samples is to characterize the quality and/or assess the condition of a natural body of water. The information sought may concern a broad range of contaminants or parameters such as in the AWQMN, or a specific contaminant or parameter suspected in an investigated incident. Natural waters can be divided into Lotic (stream or river) and Lentic (lake or open water) environments. Sampling procedures can vary among these different water bodies depending upon what is meant to be represented. Specifics of sampling plans associated with individual projects (such as the AWQMN) are included in the project's Quality Assurance Project Plan. Planned special projects involving sampling should not be conducted without development of a project-specific sampling plan. Unplanned investigations require sound professional judgment to ensure that samples that are collected will provide useful information to the investigation.

4.1.1 Lotic Environments

The correct procedure for collecting a representative sample from a river or stream depends upon the width and depth of the water body. Collect surface grab samples from streams where the flow creates enough turbulence so that the water column remains thoroughly mixed. In waters that are slow flowing and likely to exhibit stratification, collect depth-relative composite samples to represent the stream's ambient condition. Collect the sample so that it is representative of the entire water column by combining samples collected at various depths into one sample. Special projects that include sampling in lotic environments may dictate what is considered a representative sample. For example, samples collected in conjunction with the Ambient Water Quality Monitoring Network (WQN) are collected as near to mid-stream as possible and at a depth of one meter. If the depth of a water body associated with the WQN is less than two meters in depth, the sample is collected at one-half the depth.

When the sample depth and location are not determined by a project plan, use the following for guidance in sample collection to obtain representative samples.

Rivers less than 7.3 meters (m) in depth

0 to 1.2m	mid-depth. Take measurements as close to mid-stream as possible.
1.2m to 3.6m	one at 1.0 m from surface and one at 0.3 m from the bottom. Take measurements as close to mid-stream as possible.
3.6m to 7.3m	one at 1.0 m from surface, one at ½ total depth and one at 0.3 m from the bottom. Take measurements as close to mid-stream as possible.

Rivers greater that 7.3 meters in depth

At least three measurements: one at 1.0 meter from the surface, one at each 3 – meter increments to near the bottom, and one at 0.3 m from the bottom. Take measurements as close to mid-stream as possible.

4.1.2 Lentic Environments

Representative sampling of lakes and open water environments may require not only vertical characterization of the water column, but also horizontal representation as well. Use transects across an open body of water or a grid pattern to equally space sample locations. A GPS unit is very helpful in ensuring proper location of transects and grid points. Collect a vertically composited sample at each location as per the depth requirements listed in 4.1.1. These samples can represent the conditions over the entire lake or only the part relative to a particular project. If samples are collected in conjunction with the Ambient Water Quality Monitoring Network, collect the sample at a predetermined location and at a depth of one meter, or at one-half total depth if water body depth is less than 2 meters.

4.2 Compliance Sampling

Collecting water samples for compliance purposes involves either a facility discharge or sampling of ambient waters affected by such a discharge. These samples may be prompted by citizens' complaints, suspected or observed water quality problems, or to ascertain compliance status with a specific discharge permit. Proper PPE are required for this activity. Specifics of planned compliance sampling efforts should be documented prior to conducting the activity and discussed with the laboratory for concurrence.

4.2.1 Facility Sampling

Facility sampling involves the collection of wastewater from a pipe, flume, weir, or other conveyance that directs the flow to state waters. Collect samples from the designated permitted outfall when sampling for regulatory purposes. For compliance purposes, samples must be representative of the subject waste stream and be collected downstream of all treatment units and prior to commingling with other waters. If discharges are encountered that are not listed in the permit, samples from these discharges need only be representative grabs to be valid for compliance purposes.

4.2.1.1 Grab Sampling

A grab sample is one that is taken at a specific time and place in one sampling effort. This sample represents the effluent or receiving stream at the time the sample was taken. The hand sampling method is often employed for this type of sample collection, but grab sampling may be conducted using sampling devices as well. Many analytes require a grab sample as per EPA approved method and are not amenable to compositing. Some of these include dissolved oxygen, total residual chlorine, oil and grease, fecal coliform, volatile organics, sulfides, cyanides, and total phenols. Collect a grab sample if the permit, analytical method, or project-specific plan specifies that method.

4.2.1.2 Composite Sampling

A composite sample is two or more aliquots combined into a single sample taken over a period of time or discharge flow. The composite can be taken manually by combining a series of grab samples or by an automatic sampler that can be set up at a site and left for a period of time. Collecting grab samples (aliquots) of equal volume at specified time intervals and combining them provides a manual temporal composite. A flow proportioned (or flow-weighted) composite is created when flow measurements are used to determine the volume of each aliquot. For example, if the flow rate doubles between the first and second aliquot, then the volume of the second aliquot will be twice that of the first. Subsequent aliquots are also compared with the first to determine the necessary aliquot volume.

An automated composite can be collected by using an automated sampling device that is set to collect a predetermined amount of water at designated time intervals (e.g., the sampler is set to collect 500ml of sample every hour) or (when integrated with a flow meter) after a designated amount of flow (e.g., the sampler would collect 500 ml of sample for every 10,000 gallons of discharge). The sampler can either place the aliquot in separate containers at each sampling event or combine all the aliquots into one large container. If placed in separate containers, the individual aliquots can be manually flow proportioned by consulting the flow charts for the sampling period and determining each aliquot size to obtain a flow-weighted composite. For compliance purposes, collect the sample according to the permit requirements. These may specify a certain time of day when the sampling can begin or it may specify the minimum number of aliquots. In all cases, thoroughly clean sampling gear including automatic samplers inside and out before and after the sampling effort. The sampling components of the automatic sampler must be compatible with the analyte collected. For example, plastic tubes or hoses would violate sampling protocol for pesticides. In this case Teflon tubing would be required.

4.2.2 Receiving Stream Sampling

A natural water body that receives effluent from a point source discharge may be sampled to ascertain the effects of such a discharge on water quality. Sampling methods previously discussed in Section 2.0 apply to this activity. Sampling sites selection is dependent upon the location of the effluent and characteristics of the receiving stream. In lotic environments, an upstream (in uni-directional flow, non-tidal streams), or background, sample provides data on water quality of the stream prior to the influences of the subject effluent. Collecting samples just downstream of the outfall (within the mixing zone) provides information about the stream within the immediate influences of the effluent. Sampling at various distances downstream (beyond the mixing zone) provides information on the residual influences of the effluent. The resulting information provides characterization of the receiving stream before introduction of the effluent, and after where recovery should have occurred. In lentic environments, samples would be taken near the outfall and at various distances outward in a transect or grid pattern.

4.3 Parameter Specific Sampling Procedures

Standard collection techniques as outlined in Section 2.0 are applicable to the majority of the samples collected. However, the collection technique for some samples is unique to the parameter of interest. Parameters that require specialized sampling techniques include Oil and Grease, Volatile Organics, Fecal Coliforms, and Metals. The following discusses these sampling techniques.

4.3.1 Oil and Grease

When sampling for Oil and Grease, use the appropriate sample container as outlined in section 3.3. Do not rinse the sample container. In the ambient condition, collect the sample by dipping the container into the water surface in a horizontal sweeping motion. Do not allow the container to fully immerse. The scooping motion is designed to capture the first few inches of the water column. If collecting an oil and grease sample from a flowing pipe or outfall structure, allow each container o fill. Always use the Hand Sampling technique for these samples. Never composite or transfer a sample from one container to another.

The approach above is used for EPA Method 1664: analyses for oil and grease by extraction and gravimetry at relatively low levels (<1000ppm). An investigator may encounter significant volumes of oil when investigating a spill event. While it is important to secure samples of spilled oil for a number of purposes, samples containing large percentages of free (visible) oil are not suitable for this analytical method. When a sample contains significant volumes of free oil, the investigator should photograph the sample container and discuss potential alternative sample methods with their Supervisor, DCL-A, or Senior Scientist.

4.3.2 Volatile Organics (BTEX, TPH-G, Propane, etc.)

Collect volatile organic samples (VOA/VOC) in specialized 40-ml glass containers (vials). The sample vials are fitted with removable Teflon septa in the caps. Fill the vials by either hand or sampling device. Do not rinse the vials with sample prior to collection. Avoid turbulence when filling the vial as aeration may occur and lower the sample results. Slowly add the sample to the vial and avoid contact between the vial and the sampler. Overfil the bottles to where a convex meniscus or mound of water extends above the mouth of the vial. Gently place the lid with septum over the mouth of the jar and tighten. Check the vial for bubbles. Invert the vial with the lid down and then gently tap; any bubbles present can be plainly seen in the upturned vial. Should bubbles appear, pour out the sample and resample using a new container. Do not composite VOA/VOC samples. Label the vials with labels provided by the Water Laboratory. Never use duct or masking tape as labels for these vials. Place on wet ice until delivery to the laboratory.

4.3.3 Fecal Coliform

Collect samples for fecal coliform analysis by hand or by attaching the sample container to a sampling device that will not contaminate the sample. Place each sample in the appropriate container provided by the contract laboratory designed specifically for the parameter.

4.3.4 Metals

In the handling of samples for metals analyses, it is important to remember that instrumentation utilized is very sensitive and capable of producing results in the parts per billion (ppb) range. Care must be taken when handling these samples to avoid the introduction of contaminating metals. When collecting samples for metals analyses, the sample should be collected prior to all other samples. The wastewater sampler must not be placed into the water body prior to the collecting clean metal samples as the presence of metal in the water can contaminate the sample.

4.3.4.1 Total Metals

Collect these samples by hand or with a non-metallic sampling device. Since the wastewater sampler is constructed of stainless steel, it is not appropriate for metals sampling.

4.3.4.2 Modified Clean Techniques for Dissolved Metals Associated with the Ambient Water Quality Network

Dissolved metals analyses require the submission of a filtered sample. A modified clean technique that allows for efficient filtering of water samples in the field is designed to reduce the potential for contamination and has been adopted for use in the Ambient Water Monitoring Network. It involves the use of Certified Level 1 cleaned polypropylene bailers and filters that are suitable for trace metals sampling and analyses. The bailers are approximately 36 inches in length by 1.5 inches in diameter (tubes) with a fill opening and check valve at the bottom end. When the bottom of the bailer is submerged (for the purposes of the Ambient Water Quality Monitoring Network the depth of sampling would follow the same requirements in Section 4.1), ambient waters enter around the open check valve. When the desired quantity of water sample is inside the bailer it is lifted from the water. The sample will be contained by the check valve. An encapsulated filter is then attached to the bailer on the check valve end, displacing the obstruction provided by the check valve and allowing sample water to flow into the filter. A hand pump can be attached to the top of the bailer to pneumatically force the sample through the filter and into a container. This results in on-site filtration of a water sample that has not been in contact with any material that is not cleaned and suitable for trace metals analysis. Due to the detection limits associated with the clean metals, every precaution must be taken to avoid contamination of the samples. The Laboratory supplies sample containers that are certified clean for the analysis.

1. Measure the salinity of the water body and record on the chain of custody (remarks section).
   i. These guidelines are used to determine what sampling container is used based on salinity:
      - < 0.5 ppt – freshwater
      - ≥ 0.5 ppt – brackish water

   This link will provide guidance on sample containers to be used.
   http://intranet/innerweb/Surveillance/WaterQuality/AmbientWaterQualityForms/tabid/100/Default.aspx
2. Collect clean metal samples prior to any other sample.
3. Wear gloves that are talc free and constructed from polyethylene, latex, vinyl, or PVC.
4. Remove the bailer from the protective covering, attach a small rope, fishing line, etc. to the top of the bailer, and lower it into the body of water. (Do not use material that contains any metals.) For the WQN, the bailer should be lowered to the entire length of the bailer or ½ the total depth of the water body when the water body is less than 2 meters depth. If access is available to the water body, the sample can be collected by hand. However, the sample should be collected at mid-stream. NOTE: If the water body has a strong current, it may be necessary to add additional weight to the bailer. Do not weight the bailer with material that may contaminate the sample.
5. Allow the bailer to fill with the sample and remove it from the water.

6. Attach a filter and a plastic hand pump to the bailer to pneumatically force the sample through the filter and into the sample container. If the sample containers cannot be filled with one drop of the bailer, remember to fill each container at the same rate to ensure sample consistency.
7. Take precautions not to contaminate the sample containers. Do not get containers or bailers too close to face, hair, etc. because these are sources of possible contaminates.
8. More than one filter may be used as waters with significant amounts of suspended solids will clog the filter.
9. Do not reuse the bailer and filter(s). Each is used for one sample location only.
10. Place in a clean, ice filled cooler.

5.0 Water Sample Volumes, Containers, Preservation, and Holding Times

Sample collection for some parameters requires certain type containers, preservatives and handling. Adherence to the requirements ensures that the analyses are untainted by complications from contamination, degradation, and interference. Holding Times are provided for planning purposes only. DO NOT hold a sample in a regional office or vehicle; ship or deliver the sample as soon as time permits.

Links: Container guidance document - (see below)
http://intranet/innerweb/Surveillance/WaterQuality/AmbientWaterQualityForms/tabid/100/Default.aspx
Holding times - http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480212c6b.
Additional questions regarding water sample volumes, containers, preservation and holding times please direct to: (deqlabinfo@la.gov).

NOTE: AFTER THE SAMPLE IS TAKEN MAKE SURE THERE IS NO OUTSIDE CONTAMINATION ON THE SAMPLE CONTAINER(S). Some samples represent potentially unhealthy conditions. Cleaning the outside of the sealed sample container is intended to minimize contamination of ice chests and, subsequently, personnel at the receiving laboratory.

6.0 Sample Numbering and Container Labeling

It is extremely important that sample containers are plainly marked and identified as to whom, how, and where the sample was collected. Without this documentation, the samples and resulting data cannot be validated.

Number the sample containers using waterproof ink. The first three numbers identify the collector with a unique sequence. Refer to the Laboratory Services web site http://intranet/labs/index.htm for a list of Sample Collector ID Numbers. If the name of the collector cannot be located on the web site, contact deqlabinfo@la.gov. The second set of six numbers identifies the date of the beginning of the collection event in an YY/MM/DD format. The next set of two numbers identifies the sample as one of a sequence (*e.g.* 01 describes the first sample of that day, 02 the second *etc*). The final letter or number describes the type of sample such as ambient, facility discharge, grab, or composite (see Attachment 3). For instance, sample number 041-991202-05-5 indicates that Bob Crain (sample ID #41) collected the sample on December 02, 1999; it was the 5th sample collected and the sample was a grab sample collected from a facility wastewater discharge. Note: All samples collected during a sampling event will have the same sample number. Example: If you collect several samples at a site for the Ambient Water Quality Monitoring Network all the samples would have the same sample number. This would include the fecal coliform, metals, A and C containers. Another example would be samples collected at an outfall for a Compliance Sampling Inspection (CSI). All samples collected at an outfall (001) would have the same sample number.

For all Ambient samples collected the minimum data is required:

- Date
- Time
- Unique Sample ID
- Site Number (if none available see http://intranet/sop/shared/sop_1870_r01.pdf)
- Subsegment/AI
- Sample Depth

For any compliance related samples collected the minimum data is required:

- Date
- Time
- Unique Sample ID
- Facility AI
- Sample Location (Ex. Outfall 001)

See Attachment 2 for specifics.

7.0 Documentation

Surveillance personnel are provided with several activity or project specific forms to use for documentation of sampling and field water quality measurements. It is incumbent upon the sampler or designated sample team member to record all pertinent information regarding each sample as this provides additional sample history and may resolve conflicts when problems occur involving the samples or analysis. Fill out forms in black ink, legible print, and error free. If an error is made on the form, strike out the error with a single line and initial.

7.1 Field Data Forms

The following forms, Surveillance Water Quality Field Measurements (SWQFM) and Ambient Water Site Info Form are used to collected field data. These forms can be found at: http://intranet/innerweb/Surveillance/WaterQuality/AmbientWaterQualityForms/tabid/100/Default.aspx. The individual project plan will outline which form is to be used. The above link also includes guidelines on how water quality data will be electronically entered.

7.2 Field Notes

When water sampling is undertaken in conjunction with complaints, spills, or ad hoc ambient sampling, a field data form may not be practical or appropriate. In these cases, keep scrupulous field notes. Include information such as location, date and time, complaint or spill number, sequential sample number assigned to each sample, preservation, *in situ* water quality measurements, and any other pertinent facts connected with the samples. Field notes may be destroyed once the information contained therein has been transferred to the final report per LDEQ's **Records Series and Records Retention Guidelines.** (http://intranet/records)

7.3 Chain-of-Custody Form

Use this form for all samples collected, unless specified otherwise in the Project Plan. This form provides the history of a sample from its collection until the laboratory receives it. Its use is critical should enforcement or litigation result from the sampling effort. http://intranet/innerweb/Surveillance/WaterQuality/AmbientWaterQualityForms/tabid/100/Default.aspx

7.4 Compliance Monitoring Team Effort Record Form (Attachment 5)

Use this form to document the activities of a composite sampling effort either by a team or individual. One two-page form is used for each outfall for the entire effort. Complete all the blank spaces. Record information pertaining to each aliquot collection including analytes, preservatives, time, totalizer reading, flow rate, and crew initials. Record field data taken at those times in the spaces provided. The forms stay with the samples throughout collection of the final aliquot. After the effort, the completed form is retained by the team leader and is included in the final inspection report. It can also provide invaluable information should questions arise about the effort.

7.5 Notification

Laboratory personnel are given the tentative schedule of long-term sampling efforts relative to a major project (including, but not limited to, the AWQMN). If you have a change in schedule for these projects please contact deqlabinfo@la.gov. For all other sampling, contact deqlabinfo@la.gov prior to collection.

7.6 Delivery and Shipping

Delivery of samples to the lab should be accomplished to allow for analyses within specified holding times. This may involve personally delivering the samples, arranging for pick up at the regional office, or shipping them by overnight carrier as outlined in the contract. In either case, the samples must, if required by preservation standards, be maintained and arrive at ≤6°C. If shipping by common carrier, pack the container so as to preclude breakage of the sample bottles (wrap glass bottles in bubble wrap). Use plastic containers filled with water and then frozen or frozen "blue ice" to maintain the desired temperature. There must be no chance of liquid escaping the ice chest during transit. Securely tape shut ice chests used for sample shipment and place chain of custody tape on the ice chest. Include your name, date and time on the chain of custody tape. Securely fix and tape the drain plug on an ice chest to insure that it will not be dislodged. The handles should remain free from tape, as they will be needed for hand carrying the chest. Ship samples to the laboratory at the earliest possible opportunity after collection. In the event hazardous materials are shipped, then all packaging should comply with US DOT regulations.

8.0 Safety Concerns

Water sampling, like all types of field work, involves a certain amount of risk. Care must be taken to observe practices that will minimize the chance of injury or sickness. The use of surgical gloves when sampling not only reduces the risk of contacting disease causing agents, but also protects from some potentially hazardous chemicals and preservatives. Potential contact with hazardous chemicals can be protected with the use of the appropriate PPE. Make sure that the vehicle is stocked with provisions for washing and disinfecting gear and hands. Samples are often collected from bridges, boats and other inherently dangerous locations. Traffic on those bridges poses a serious threat and extreme vigilance is important. In boats, life jackets must be worn. During inclement weather, care must be taken to protect oneself from the elements. Maintain communication via radio or cell phone to insure help could be summoned if needed. Consideration should be given to sampling in teams when necessary for safety.

9.0 Sonde Deployment

9.1 Introduction

The main use of electronic water quality monitoring instruments is the characterization of ambient or discharged waters. The method of deployment of the instruments will in most cases determine if accurate and representative measurements are obtained from these waters. The two basic types of measurements are instantaneous (profiling) and continuous (autonomous). The former is a snapshot of the conditions at the time of the reading while the latter is a measurement of the water quality over an extended period of time. Both methods require specific deployment strategies.

The following procedures are intended to be utilized as an important tool in training employees and as a reference tool for employees already trained. The use of standardized procedures helps ensure the quality, effectiveness and efficiency of activities in support of the Department's environmental missions.

9.2 Instantaneous Measurements

Instantaneous measurements make up the majority of water quality monitoring conducted. It is simply the immersion of a calibrated water quality monitoring instrument (sonde) in an ambient water, discharged effluent, or impounded wastewater to measure specific parameters. This activity can be in response to a citizen's complaint, spill, water quality project, fish kill, compliance inspection, or other activity where water quality information is needed. It is important that the measurements be made in such a way as to produce data that are representative of the water in question. It is also important that these data be fully recorded as well as the time of day, exact location, weather conditions, and initials of person making the measurements. Some forms used are designed to include water quality measurements and prompt for the other required information. Refer to the appropriate section in this SOP for additional details concerning documentation and collection of data obtained using sondes.

9.2.1 Ambient Waters

For the purpose of this SOP, ambient waters are defined as any waterbody not within a facility or conveying a discharge directly from a facility and in most cases may be considered synonymous with waters of the state. These include all lakes, streams, rivers, creeks, and most ponds, bayous, canals, and ditches. Water quality monitoring locations for these types of water bodies are similar to sampling locations. Refer to the project's Quality Assurance Project Plan (QAPP) and the section in this SOP for guidance concerning sampling points and documentation of data. Sampling points and measurement points are usually identical in location and in depth. Measurements are taken using an appropriately calibrated sonde at specific depths. Refer to the SOP specific for the sonde utilized for detailed procedures concerning calibration, maintenance, and use of the instrument. The following details procedures for deployment of sondes in Ambient Waters.

1. Remove the calibration cup and cap from the sonde.
2. Attach the sensor guard to the sensor end on the sonde and snuggly tighten it, being careful not to over-tighten the guard.
3. Place the sonde into the water and lower it to the desired depth or depths. Use the depth function of the meter, if applicable, or use the depth marks on the cable to determine the depth of the sonde's probes at any time.
4. At each measurement depth, allow ample time for the sonde to equilibrate to temperature and changes in parameters.
5. Allow ample time for all parameters to stabilize. Record measurements when little or no significant variation is observed in the readings.
6. After all measurements have been recorded, remove the sonde from the water.
7. Remove the sensor guard. If fouling of the sonde occurred, rinse the sensors thoroughly with distilled, deionized, or tap water.
8. Replace the calibration cup and cap (filled with distilled, deionized, or tap water) until further analysis is needed.
9. Upon return to the office, rinse the sonde with distilled, deionized, or tap water.
10. Discard the water in the calibration cup and cap and replace with "fresh" water (distilled, deionized, or tap).
11. Place the calibration cup and cap on the sonde and store instrument until needed. The sonde shall be stored in a climate controlled environment and out of direct sunlight.

Unless the measurement point has been defined, ensure that measurements are representative of the waterbody. This requires that the size, shape, and depth of the waterbody be considered and factored into the monitoring activity. For stream (lotic) environments, a midstream reading is preferable unless a transect across the stream width is called for in the project plan. The midstream location usually is at the deepest point of the transect and the area of swiftest flow. For lake (lentic) environments, various depths and transect readings may be required to fully characterize the water quality. The Ambient Water Quality Monitoring Network Program (WQN) requires that all readings be made at a depth of one meter. If the depth of a water body associated with the WQN is less than one meter in depth, collect the sample at mid-depth. For example, If a water body is determined to be 0.6 meters deep, then the monitoring depth should be at 0.3 meters. The depths where readings are taken are dependent upon the total depth. Use the following as a guide to determine depths to be measured:

Rivers less than 7.3 meters (m) in depth

0 to 1.2m	mid-depth. Take measurements as close to mid-stream as possible.
1.2m to 3.6m	one at 1.0 m from surface and one at 0.3 m from the bottom. Take measurements as close to mid-stream as possible.
3.6m to 7.3m	one at 1.0 m from surface, one at ½ total depth and one at 0.3 m from the bottom. Take measurements as close to mid-stream as possible.

Rivers greater that 7.3 meters in depth

At least three measurements: one at 1.0 meter from the surface, one at each 3 – meter increments to near the bottom, and one at 0.3 m from the bottom. Take measurements as close to mid-stream as possible.

Specific conditions encountered may dictate a deviation to the above guideline. For example if an algae bloom is present, water quality measurement at a depth of 0.5 meters, in addition to those on the guideline, may be taken.

Many instances call for the determination of the thermocline, which is observed as a significant change in dissolved oxygen concentration, pH, or salinity by depth. This will involve many more measurements than delineated in the guideline. The expertise and experience of the personnel will ultimately determine if any addition or deletion of measurement points is to be made.

Determine the points where measurements will be taken by evaluating the situation. Generally, measurements are needed not only in the area of concern, but also upstream or unaffected areas, and downstream or areas of recovery. Obtain any measurement that can further clarify a water quality question. As mentioned above, experience and expertise is invaluable for these decisions. Document and justify deviations from standard protocol.

Access to sampling points will also determine, in many cases, where measurements will be made. Safety should always be a concern when working off of bridges or out of boats. When working out of boats, wear a life jacket at all times.

Refer to the Quality Assurance Project Plan (QAPPs) specific to the study and to the section in this SOP for additional information concerning the deployment of sondes and sample locations for the purpose of obtaining representative data.

9.2.2 Effluent Characteristics

As part of permit compliance inspections, measurement of effluent quality with a sonde is often advisable and required. A main concern is the point of measurement. Sampling points and measurement points are identical in location in depth. Select a point in the effluent flow that is downstream of all treatment units and prior to commingling with other waters. Refer to Section 4.2 in this SOP for additional details concerning sampling points and documentation of data. The following outlines procedures when measuring water quality parameters from an outfall or other discharge point:

1. Wear waterproof gloves.
2. Remove the calibration cup and cap from the sonde.
3. Attach the sensor guard to the sensor end on the sonde and snuggly tighten it, being careful not to over-tighten the guard.
4. Fully submerge the sonde with the bottom pointed "downstream" or with the flow.
5. Allow ample time for the sonde to equilibrate to temperature and changes in parameters.
6. Allow ample time for all of the parameter to stabilize. Record results after little or no variation is seen in the readings.
7. Remove the sonde from the water.
8. Remove the sensor guard. Rinse the sonde with distilled, deionized, or tap water.
9. Re-attach the calibration cup and cap and store until further analysis is needed.
10. Upon return to the office, rinse the sonde with distilled, deionized, or tap water.
11. Discard the water in the calibration cup and cap and replace with "fresh" water (distilled, deionized, or tap).
12. Place the calibration cup and cap on the sonde and store instrument until needed. The sonde shall be stored in a climate controlled environment and out of direct sunlight.

9.3 Continuous Monitoring

Data collected from autonomous (i.e., continuous monitor or CM) sonde sets are utilized to collect numerous discreet data points over a relatively short period of time. For the purposes of the AWQMN, CM data for dissolved oxygen can be used to verify or override grab data for dissolved oxygen. This is important when grab data for dissolved oxygen during a routine AWQMN run is below the criteria for the sampled water body. If the AWQMN sampler records grab data for dissolved oxygen below the criteria, CM data should be initiated within two to seven days after the grab data is collected, provided that environmental conditions are similar to those encountered during grab data collection. If the sampler, in consultation with the DCL-A and/or Supervisor, believes that CM data collection is not appropriate for any reason, the sampler and other involved regional personnel must request approval to disregard CM data collection from Senior Scientists for Water at DEQ HQ. The HQ Senior(s) will engage the WQAD for confirmation of approval to disregard CM data collection. The procedures for obtaining data sets with continuous monitoring sondes are outlined in the link below:
http://intranet/innerweb/Surveillance/WaterQuality/AmbientWaterQualityForms/tabid/100/Default.aspx
For any unusual conditions including abnormal weather conditions, record this information in the comments section of the form outlined in the project plan.

9.4 Quality Control Measures

Many of the Quality Control measures used to ensure that quality data are collected are detailed in the SOP for Calibration, Maintenance and Operation of Hydrolab MiniSonde 5. QC practices vary somewhat depending on the purpose of deployment.

9.4.1 Instantaneous Measurements

Instantaneous measurements are used to collect data in support of the Water Quality Monitoring Network, to aid in the investigation of a complaint or spill, to gather discreet information on a particular water body, and to aid in the determination of compliance to NPDES permit requirements. The following represent routine QC practices associated with instantaneous measurements, details on how to conduct each one can be obtained from the SOP for Calibration, Maintenance and Operation of Hydrolab MiniSonde 5:

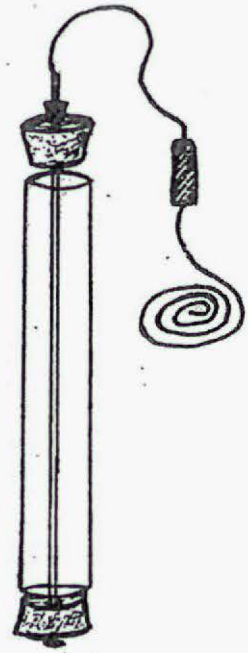
- Calibrate the sonde within 24 hours of use
- Post Calibrate the sonde within 24 hours of use
- Perform routine maintenance of the sonde as needed or required
- Use appropriate and unexpired buffers in calibration
- Use fresh batteries with an adequate charge or "life"
- Store and transport the sonde carefully
- Document calibration and maintenance information in the sonde-specific log book

9.4.2 Continuous Monitors

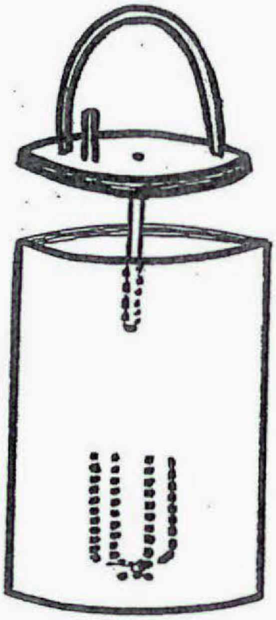
Continuous monitors (sondes) are deployed for a period of time. The information gathered is used to support and help define the water quality of a body of water or of a basin segment. Since the sondes are deployed over a period of days, it is imperative that QC activities are performed both before and after the deployment. The information obtained from the QC activities allows data to be validated. Procedures include the following:

- Calibrate the sonde within 24 hours of use and record the data in the appropriate logbook
- Post Calibrate and perform maintenance on the sonde within 24 hours of use and record the data in the sonde-specific logbook
- Maintain a schedule of routine maintenance of the sonde and record in the sonde-specific log book
- Use appropriate and unexpired buffers in calibration
- Use fresh batteries with an adequate charge or "life"
- Store and transport the sonde carefully

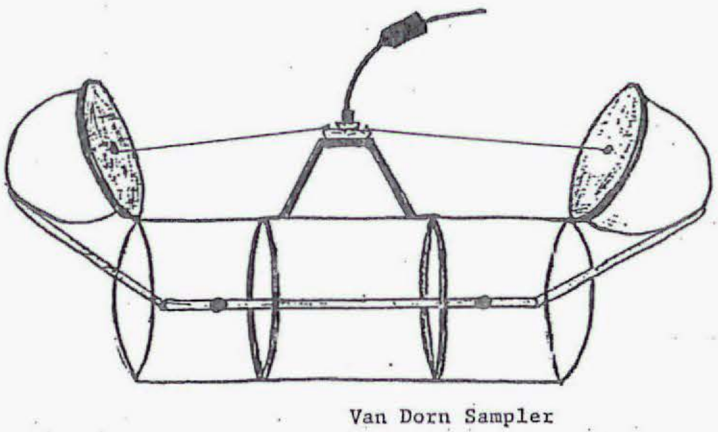
ATTACHMENTS



Kemmerer Sampler



Wastewater Sampler

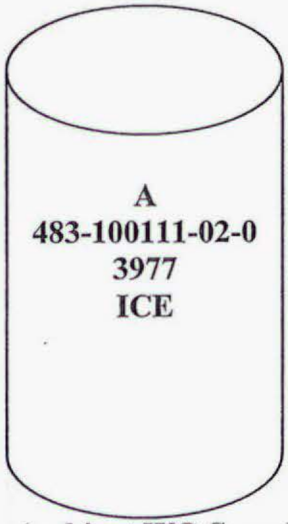


Van Dorn Sampler

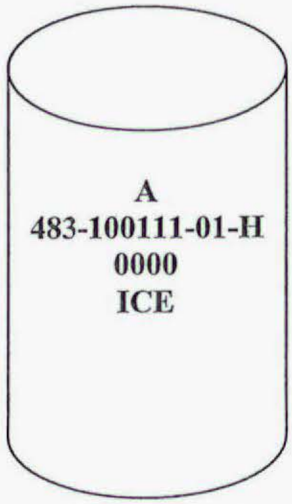
Water Sampling Devices

Ambient WQ Bottle Labeling:

Example:
Parameter (Fecal Coliform)/Parameter Code (A, C)
Sample ID
Site #
Preservative

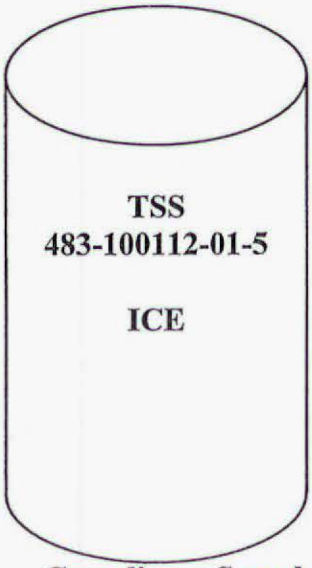


Ambient WQ Sample



Blank Sample (Only A & C)

Compliance Sample
Example:
Parameter (TSS)
Sample ID
Preservative



Compliance Sample

If the bottles are already stamped with the chemical preservative, you need to write ICE on the bottles.

For all VOC/VOA samples label both the bags & the bottles as outlined above.

SAMPLE NUMBERING FORMAT

0 - Ambient water sample, grab
1 - Ambient water sample, spatial composite (vertical in water column)
2 - Ambient water sample, spatial composite (horizontal transect)
3 - Ambient water sample, spatial composite (vertical and horizontal)
4 - Ambient water sample, temporal composite (over time)
5 - Facility wastewater discharge sample, grab
6 - Facility wastewater discharge sample, flow proportional composited over time period
7 - Facility wastewater discharge sample, temporal composite (collected over time but not flow proportioned)
8 - Facility wastewater sample, not being discharged at time or point of collection but within an impoundment or unit of a treatment works (e.g. reserve pit, oxidation pond, biotreatment pond, etc.)
9 - Facility wastewater sample, collected from ditch or other conveyance located within facility premises but not flowing from the premises (e.g. pooled wastewater in stormwater ditch)

A - Biological sample for tissue residue analysis
B - Sediment sample (hydrosoil), single grab or composite of multiple grabs collected at same station locality and time but not from a transect or grid
C - Sediment sample (hydrosoil), composite of multiple grabs taken at same general locality but from a transect grid
D - Soil sample, a single grab or composite of multiple grabs collected at same station locality and time but not from a transect grid
E - Soil sample, composite of
F - Raw water intake (industrial or municipal)
G - Finished water supply, collected from a publicly owned potable treatment facility
H - Field blank
I - Privately owned water well
J - Recovery-monitoring well

SAMPLE NUMBERING
EXAMPLE
057-840107-03-3

The first block of numbers (057) reflects the identification code of the person that collected the sample. The second block of numbers (840101) indicates the date when the sample was collected, (January 7, 1984). The third block of numbers (03) indicates that this was the third sample collected on that date. The last number (3) shows that this was an ambient water sample composited from a vertical and horizontal transect within the stream.

Compliance Monitoring Team Effort Record Form

Permit #:

Company:

Facility:

Location:

Outfall #:

Starting Time and Date:

Stopping Time and Date:

Multi-probe Analyzer #:

Shift Members

1.__________ 2.__________

3.__________ 4.__________

5.__________ 6.__________

7.__________ 8.__________

9.__________ 10.__________

11.__________ 12.__________

		Aliquot											
Field Data	**Preservatives**	1	2	3	4	5	6	7	8	9	10	11	12
Time	None												
Temperature	None												
Conductivity	None												
pH	None												
Dissolved Oxygen	None												
Residual Chlorine	None												
Samples	**Preservatives**												
BOD5 TSS Alkalinity	Wet Ice												
Oil & Greases	H2SO4 to pH<2 Wet Ice												
COD	H2SO4 to pH<2 Wet Ice												
Ammonia	H2SO4 to pH<2 Wet Ice												
Phenol	H2SO4 to pH<2 Wet Ice												
TOC	H2SO4 to pH<2 Wet Ice												
Metals	H2NO3 to pH<2 Wet Ice												
Hexavalent Chromium	Wet Ice												
Sulfide	Zn Acetate+NaOH ph>9 wet ice												
Flouride	Wet Ice												
Pesticides	Wet Ice												
Coliform	Wet Ice												
VOC	Wet Ice												
Crew Initials													

Sample Location:______________________________________

Aliquot#	Totalizer	Flow	Aliquot Time	Crew Initials

Aliquot = New	Flow / Original Flow	X	First Aliquot Volume

Comments:

Sample#: ______________________________________

APPENDIX C

TABLES

TABLE 1
MONITORING WELL DATA

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Well ID	Northing	Easting	Latitude	Longitude	Well Diameter (inches)	Total Well Depth (ft bgs)	Top of Casing Elevation (NGVD)	Ground Surface Elevation (NGVD)	Screened Interval Elevation (NGVD)	Screened Interval (ft bgs)
First Water-Bearing Zone										
DW-1	701226.57	3571439.3	30^0 25' 30"	90^0 24' 41"	2	19	13.36	12.03	3.5 to -6.5	8.5 to 18.5
DW-2	700994.96	3571554.5	30^0 25' 28"	90^0 24' 39"	2	11	14.12	12.65	7.2 to 2.2	5.5 to 10.5
DW-3	701096.8	3571730.9	30^0 25' 29"	90^0 24' 37"	2	16	11.59	10.09	4.6 to -5.4	5.5 to 15.5
MW-1	701242.6	3571218.6	30^0 25' 30"	90^0 24' 43"	2	28.5	15.08	13.58	0.6 to -14.4	13.0 to 28.0
MW-2	700954.99	3571119.9	30^0 25' 27"	90^0 24' 44"	2	10.5	14.23	11.79	6.8 to 1.8	5.0 to 10.0
MW-6	700833.83	3571351.4	30^0 25' 26"	90^0 24' 42"	2	16.5	16.77	15.17	NA	NA
MW-7*	701240.79	3571056.2	30^0 25' 30"	90^0 24' 45"	2	15	8.21	6.01	NA	NA
PW-4	701018.61	3571950.1	30^0 25' 28"	90^0 24' 35"	2	19.5	12.22	8.96	NA	NA
BA-03	701018.61	3571248.6	30^0 25' 28"	90^0 24' 43"	2	13.5	14.57	11.8	8.80 to -1.20	3.0 to 13.0
BA-09	701286.58	3571522.6	30^0 25' 31"	90^0 24' 40"	2	18.0	9.46	8.10	0.60 to -9.40	7.5 to 17.5
BC-31*	701305.48	3571090.6	30^0 25' 31"	90^0 24' 48"	2	16	11.36	8.75	3.25 to -6.75	5.5 to 15.5
GSGP-3	NA	NA	30^0 25' 30"	90^0 24' 47"	0.75	13.1	7.935	NA	-0.31 to -5.41	8.1 to 13.1
GSGP-6	NA	NA	30^0 25' 31"	90^0 24' 42"	0.75	14.3	11.725	NA	-0.66 to -5.76	9.3 to 14.3
GSGP-15	NA	NA	30^0 25' 29"	90^0 24' 37"	0.75	15.3	13.483	NA	1.07 to -4.03	10.3 to 15.3
GSGP-18	NA	NA	30^0 25' 27"	90^0 24' 43"	0.75	11.5	15.284	NA	8.88 to 3.78	6.5 to 11.5
GSGP-19	NA	NA	30^0 25' 27"	90^0 24' 45"	0.75	13.5	13.463	NA	3.56 to -1.54	8.5 to 13.5
GSGP-22	NA	NA	30^0 25' 30"	90^0 24' 39"	0.75	14.85	8.382	NA	-1.37 to -6.47	9.8 to 14.8
NWGS-01	NA	NA	30^0 25' 27"	90^0 24' 44"	1.5	11.0	12.937	10.44	4.54 to -0.56	5.9 to 11.0

Notes: 1) ft bgs = Feet below ground surface
2) ID = Identification
3) NA= Not available
4) NGVD = National Geodetic Vertical Datum
5) * = Well Plugged and Abandoned by the EPA

TABLE 1
MONITORING WELL DATA

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Well ID	Northing	Easting	Latitude	Longitude	Well Diameter (inches)	Total Well Depth (ft bgs)	Top of Casing Elevation (NGVD)	Ground Surface Elevation (NGVD)	Screened Interval Elevation (NGVD)	Screened Interval (ft bgs)
First Water-Bearing Zone										
NWGS-02	NA	NA	30^{0} 25' 27"	90^{0} 24' 45"	1.5	13.1	12.757	10.16	2.16 to -2.94	8.0 to 13.1
NWGS-03	NA	NA	30^{0} 25' 29"	90^{0} 24' 44"	1.5	14.5	13.355	10.66	1.26 to -3.84	9.4 to 14.5
NWGS-04	NA	NA	30^{0} 25' 30"	90^{0} 24' 42"	1.5	11.9	11.191	8.79	1.99 to -3.11	6.8 to 11.9
NWGS-05	NA	NA	30^{0} 25' 30"	90^{0} 24' 37"	1.5	9.9	11.058	8.31	3.51 to -1.59	4.8 to 9.9
NWGS-06	NA	NA	30^{0} 25' 27"	90^{0} 24' 45"	1.5	12.0	11.725	9.03	2.13 to -2.97	6.9 to 12.0
TEPA-P7D	NA	NA	30^{0} 25' 27"	90^{0} 24' 46"	1	NA	NA	NA	NA	NA
Second Water-Bearing Zone										
DW-4	7000081.4	3571557.4	30^{0} 25' 19"	90^{0} 24' 39"	2	38	14.21	13	-14.5 to -24.5	27.5 to 37.5
MW-A	701114.99	3571481.7	30^{0} 25' 29"	90^{0} 24' 40"	2	27.0	15.12	12.35	-4.2 to -14.2	16.5 to 26.5
MW-3	700801.96	3571573.60	30^{0} 25' 26"	90^{0} 24' 39"	2	27.5	14.8	12.83	-4.2 to 14.2	17.0 to 27.0
MW-4	701248.27	357817.05	30^{0} 25' 30"	90^{0} 24' 36"	2	24.0	17.38	14.67	1.2 to -8.8	13.5 to 23.5
MW-5*	701508.89	3571524.3	30^{0} 25' 33"	90^{0} 24' 40"	2	20.0	11.43	8.89	-5.6 to -10.6	14.5 to 19.5
BA-01	700965.85	3571654	30^{0} 25' 27"	90^{0} 24' 38"	2	26.0	14.57	11.48	-4.02 to -14.02	15.5 to 25.5
BA-05	701084.30	3571574.7	30^{0} 25' 29"	90^{0} 24' 39"	2	18.5	14.20	11.02	3.02 to -6.98	8.0 to 18.0
BA-09A	701290.47	3571515.1	30^{0} 25' 31"	90^{0} 24' 40"	2	42.0	11.10	7.92	-23.58 to -33.58	31.5 to 41.5
BC-01*	699516.45	3571517.6	30^{0} 25' 13"	90^{0} 24' 40"	2	26.5	15.99	13.35	-2.65 to -12.65	16.0 to 26.0
BC-03	699684.61	3571900.1	30^{0} 25' 15"	90^{0} 24' 36"	2	28.0	16.32	13.78	-3.72 to -13.72	17.5 to 27.5
BC-07	699855.32	3571454.1	30^{0} 25' 16"	90^{0} 24' 41"	2	18.5	11.37	8.19	0.19 to -9.81	8.0 to 18.0
BC-11*	699967.64	3571524.00	30^{0} 25' 18"	90^{0} 24' 40"	2	28.5	15.72	12.53	-5.47 to -15.47	18.0 to 28.0
BC-17	700232.77	3571685.2	30^{0} 25' 20"	90^{0} 24' 38"	2	28.0	15.18	12.22	-5.28 to -15.28	17.5 to 27.5

Notes: 1) ft bgs = Feet below ground surface
2) ID = Identification
3) NA= Not available
4) NGVD = National Geodetic Vertical Datum
5) * = Well Plugged and Abandoned by the EPA

TABLE 1
MONITORING WELL DATA

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Well ID	Northing	Easting	Latitude	Longitude	Well Diameter (inches)	Total Well Depth (ft bgs)	Top of Casing Elevation (NGVD)	Ground Surface Elevation (NGVD)	Screened Interval Elevation (NGVD)	Screened Interval (ft bgs)
Second Water-Bearing Zone										
BC-19	700257.08	3571479.8	30^0 25' 20"	90^0 24' 40"	2	22.5	13.85	10.92	-1.08 to -11.08	12.0 to 22.0
BC-21R	700499.25	3571655.5	30^0 25' 23"	90^0 24' 38"	2	17.5	15.28	12.62	0.62 to -4.38	12.0 to 17.0
BC-25	700599.29	3571504.10	30^0 25' 24"	90^0 24' 40"	2	32.0	15.73	12.66	-8.84 to -18.84	21.5 to 31.5
BC-27*	700721.57	3571738.1	30^0 25' 25"	90^0 24' 37"	2	28.0	15.91	13.04	-4.46 to -14.46	17.5 to 27.5
Third-Water-Bearing Zone										
BA-03A	701004.96	3571249.7	30^0 25' 43"	90^0 24' 43"	2	100.0	14.76	11.72	-77.78 to -87.78	89.5 to 99.5
BA-05A	701085.48	3571565.3	30^0 25' 29"	90^0 24' 39"	2	54.0	14.42	11.16	-24.84 to -28.34	36.0 to 39.5
BB-01	699827.30	3571572.4	30^0 25' 16"	90^0 24' 39"	2	96.0	15.75	12.69	-72.81 to -82.81	85.5 to 95.5
BA-01A	700957.45	3571661.4	30^0 25' 27"	90^0 24' 38"	2	46.0	15.03	11.61	-23.89 to -33.89	35.5 to 45.5

Notes: 1) ft bgs = Feet below ground surface
2) ID = Identification
3) NA= Not available
4) NGVD = National Geodetic Vertical Datum
5) * = Well Plugged and Abandoned by the EPA

TABLE 2
WATER WELL DATA

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Well ID	Address	Depth (feet)	Date Installed
WW-04[1]	39229 Keaghey Road Ponchatoula, LA 70454	Unknown	Unknown
WW-09[1]	39233 Keaghey Road Ponchatoula. LA70454	60	10/94
North Well[1]	19119 Weinberger Road Ponchatoula. LA 70454	Unknown	Unknown
South Well[1]	19113 Weinberger Road Ponchatoula, LA 70454	Unknown	Unknown
[redacted] Well[2]	Keaghey Road Ponchatoula. LA70454	Unknown	Unknown

Notes:
[1] Designations for water wells were obtained from the Delatte Metals Remedial Investigation Report (Tetra Tech 2000).
[2] Designation was assigned based on current owners name.

TABLE 3
SAMPLE COLLECTION FREQUENCY SUMMARY

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Sample ID	Sample Collection Frequency	Reporting Frequency	Analyses Required
First Water-Bearing Zone Monitoring Wells			
DW-1	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
DW-2	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
DW-3	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
MW-1	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
MW-2	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
MW-6	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
PW-4	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BA-03	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BA-09	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
GSGP-3	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
GSGP-6	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
GSGP-15	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
GSGP-18	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
GSGP-19	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
GSGP-22	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
NWGS-01	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides

Notes: 1) * All monitoring wells will be sampled for total metals. Monitoring wells will be sampled for dissolved metals as needed based upon turbidity readings in the field. All surface water samples will be sampled for both total and dissolved metals.

2) ** Monitoring wells in the 3rd WBZ will be sampled annually and the results will be included in the semi-annual reports.

TABLE 3
SAMPLE COLLECTION FREQUENCY SUMMARY

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Sample ID	Sample Collection Frequency	Reporting Frequency	Analyses Required
First Water-Bearing Zone Monitoring Wells			
NWGS-02	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
NWGS-03	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
NWGS-04	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
NWGS-05	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
NWGS-06	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
TEPA-P7D	Semi-Annual	Semi-Annual	Total and Dissolved Metals*, Sulfates, Sulfides
Second Water-Bearing Zone Monitoring Wells			
DW-4	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
MW-A	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
MW-3	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
MW-4	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BA-01	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BA-05	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BA-09A	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BC-03	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BC-17	Semi-Annual	Semi-Annual	Total and Dissolved Metals*

Notes: 1) * All monitoring wells will be sampled for total metals. Monitoring wells will be sampled for dissolved metals as needed based upon turbidity readings in the field. All surface water samples will be sampled for both total and dissolved metals.

2) ** Monitoring wells in the 3rd WBZ will be sampled annually and the results will be included in the semi-annual reports.

TABLE 3
SAMPLE COLLECTION FREQUENCY SUMMARY

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Sample ID	Sample Collection Frequency	Reporting Frequency	Analyses Required
Second Water-Bearing Zone Monitoring Wells			
BC-19	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BC-21R	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
BC-25	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
Third-Water-Bearing Zone Monitoring Wells			
BA-03A	Annual	Semi-Annual**	Total and Dissolved Metals*
BA-05A	Annual	Semi-Annual**	Total and Dissolved Metals*
BB-01	Annual	Semi-Annual**	Total and Dissolved Metals*
BA-01A	Annual	Semi-Annual**	Total and Dissolved Metals*
Water Supply Wells			
WW-04	Quarterly	Quarterly	Total Metals
WW-09	Quarterly	Quarterly	Total Metals
North Well	Quarterly	Quarterly	Total Metals
South Well	Quarterly	Quarterly	Total Metals
[redacted] Well	Quarterly	Quarterly	Total Metals
Surface Water			
CA-41	Semi-Annual	Semi-Annual	Total and Dissolved Metals*

Notes: 1) * All monitoring wells will be sampled for total metals. Monitoring wells will be sampled for dissolved metals as needed based upon turbidity readings in the field. All surface water samples will be sampled for both total and dissolved metals.

2) ** Monitoring wells in the 3rd WBZ will be sampled annually and the results will be included in the semi-annual reports.

TABLE 3
SAMPLE COLLECTION FREQUENCY SUMMARY

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Sample ID	Sample Collection Frequency	Reporting Frequency	Analyses Required
Surface Water			
CA-51	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
CL-05	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
CL-19	Semi-Annual	Semi-Annual	Total and Dissolved Metals*
Bridge	Semi-Annual	Semi-Annual	Total and Dissolved Metals*

Notes: 1) * All monitoring wells will be sampled for total metals. Monitoring wells will be sampled for dissolved metals as needed based upon turbidity readings in the field. All surface water samples will be sampled for both total and dissolved metals.

2) ** Monitoring wells in the 3rd WBZ will be sampled annually and the results will be included in the semi-annual reports.

TABLE 4

SAMPLE PARAMETER, ANALYSES, VOLUME, CONTAINER, PRESERVATION, AND HOLDING TIME REQUIREMENTS

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

Parameter	Analytical Method	Volume and Container	Preservation Technique	Holding Time	
				Extraction	Analysis
Total Metals: Arsenic Cadmium Lead Manganese Nickel Zinc	SW-846 6020 or 6010	1 - 250 mL polyethylene bottle	Store at 4 EC, pH < 2 HNO_3	NA	180 days
Dissolved Metals: Arsenic Cadmium Lead Manganese Nickel Zinc	SW-846 6020 or 6010	1 - 250 mL polyethylene bottle	Store at 4 EC, pH < 2 HNO_3	NA	180 days
Sulfate	SW-846 9056	1 - 250 mL polyethylene bottle	Store at 4 EC	NA	28
Sulfide	SW-846 9034	1 - 250 mL polyethylene bottle	Store at 4 EC, pH > 9, ZnAcNaOH	NA	7

Notes:
1) Dissolved metals samples are collected as needed based on turbidity, and field filtered.

TABLE 5
SCHEDULE OF EVENTS

Delatte Metals Superfund Site
Ponchatoula, Louisiana
Agency Interest No. 2328

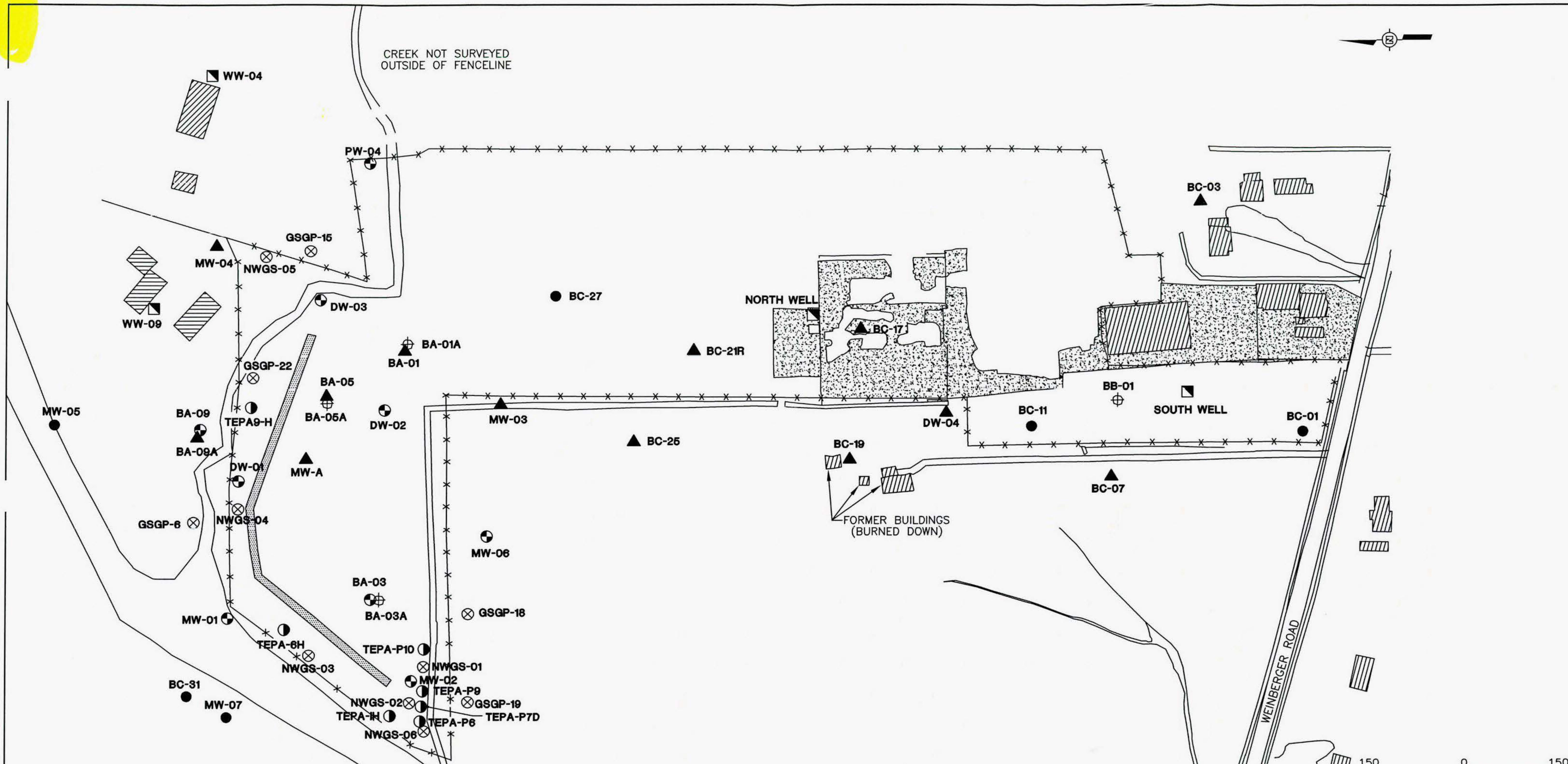
Quarter	Activities	Action
4th Quarter 2013	1st and 2nd WBZ MW sampling (semi-annual) Surface water sample collection (semi-annual) 3rd WBZ MW sampling (annual) On and off-facility WW sampling (quarterly) Build new access road to the PRB Routine Inspection - ensure MWs are labeled and locked - MW concrete pad - MW protective cover - MW locks (present and functional) - MW damage - site-wide erosion and PRB subsidence	 See LDEQ 2013 Specifications label and lock as necessary repair as necessary repaint or repair as necessary replace as necessary repair, P&A, replace as necessary import topsoil and replant grass as necessary
1st Quarter 2014	On and off-facility WW sampling (quarterly) Routine Inspection - ensure MWs are labeled and locked - MW concrete pad - MW protective cover - MW locks (present and functional) - MW damage - site-wide erosion and PRB subsidence	 label and lock as necessary repair as necessary repaint or repair as necessary replace as necessary repair, P&A, replace as necessary import topsoil and replant grass as necessary
2nd Quarter 2014	1st and 2nd WBZ MW sampling (semi-annually) Surface water sample collection (semi-annually) On and off-facility WW sampling (quarterly) Routine Inspection - ensure MWs are labeled and locked - MW concrete pad - MW protective cover - MW locks (present and functional) - MW damage - site-wide erosion and PRB subsidence	 label and lock as necessary repair as necessary repaint or repair as necessary replace as necessary repair, P&A, replace as necessary import topsoil and replant grass as necessary
3rd Quarter 2014	On and off-facility WW sampling (quarterly) Routine Inspection - ensure MWs are labeled and locked - MW concrete pad - MW protective cover - MW locks (present and functional) - MW damage - site-wide erosion and PRB subsidence	 label and lock as necessary repair as necessary repaint or repair as necessary replace as necessary repair, P&A, replace as necessary import topsoil and replant grass as necessary

Notes:

MW	Monitoring Well
P&A	Plug and abandon
PRB	Permeable Reactive Barrier
WW	Water Well
WBZ	Water Bearing Zone

APPENDIX D

FIGURES



LEGEND

- FIRST WATER-BEARING ZONE MONITORING WELL
- USGS MONITORING WELL-FIRST WATER-BEARING ZONE
- SECOND WATER-BEARING ZONE MONITORING WELL
- THIRD WATER-BEARING ZONE MONITORING WELL
- PLUGGED WELL
- WATER SUPPLY WELL
- EPA PIEZOMETERS-FIRST WATER BEARING ZONE
- UNDERGROUND PERMEABLE REACTIVE BARRIER
- FENCE
- CONCRETE
- EXISTING BUILDING

NOTE:

1) MAP WAS COPIED FROM THE SITE MAP IN THE O&M MANUAL DATED MAY 2004.
2) SITE LOCATED IMMEDIATELY ADJACENT TO 19113 WEINBERGER ROAD, PONCHATOULA, LOUISIANA
3) SITE IS LOCATED AT GRID COORDINATES 30° 25' 16" N. AND 90° 24' 39" W.
4) EPA PIEZOMETERS WERE ADDED BASED ON LOCATIONS PROVIDED BY EPA.
5) THE [redacted] WELL IS NOT SHOWN ON THIS MAP, BUT IS LOCATED APPROXIMATELY 400 FEET EAST OF WATER WELL WW-04.
6) MONITORING WELL GSGP-03 IS NOT SHOWN ON THIS MAP, BUT IS LOCATED APPROXIMATELY 330 FEET WEST OF MONITORING WELL MW-01.

DRAWN BY	LDG 01/28/15	CHECKED BY / APPROVED BY	DRAWING NO. NEW FAC

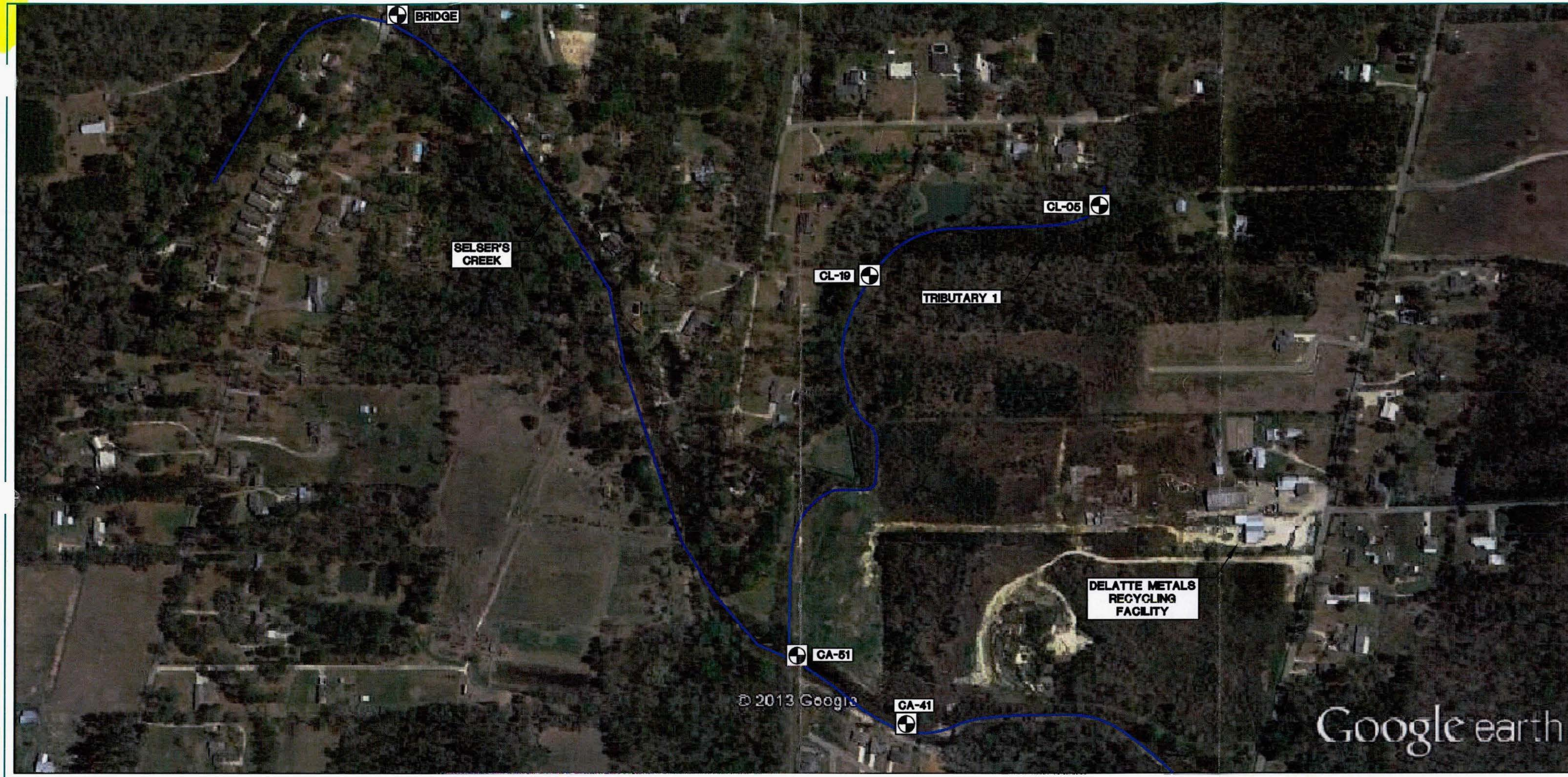
FIGURE 1

FACILITY MAP

DELATTE METALS SUPERFUND SITE
PONCHATOULA, LOUISIANA
AGENCY INTEREST NO. 2328

PREPARED FOR:
LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

SEMS Inc.



LEGEND

⊕ SURFACE WATER SAMPLE LOCATION

APPROXIMATE SCALE IN FEET

305 0 305

DRAWN BY	LDG 01/06/14	CHECKED BY: APPROVED BY:	DRAWING NO. OM

FIGURE 2

SURFACE WATER SAMPLE LOCATIONS

DELATTE METALS SUPERFUND SITE
PONCHATOULA, LOUISIANA
AGENCY INTEREST NO. 2328

PREPARED FOR:
LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

SEMS Inc.

APPENDIX E

TREND ANALYSIS FOR INTRAWELL COMPARISONS;

COMPARISONS OF UPGRADIENT VERSUS DOWNGRADIENT WELLS

TREND ANALYSIS FOR INTRAWELL COMPARISONS

Trend analysis is a statistical tool used to detect and evaluate temporal or spatial trends in a data set. Trend analysis is a useful way to evaluate changes within one well or sampling location. Preferably, any data set evaluated for trends over time will have at least eight time-independent observations and a minimum detection rate of 50 percent (EPA 2000). As the number of observations grows over time, so does the certainty of observed trends.

There are several different statistical tests that may be used for evaluating whether a trend exists, with a given probability. The Mann-Kendall test, the Kendall tau test, and Sen's Slope Estimator are appropriate nonparametric tests that are less sensitive to outliers than parametric regression methods. Regression control charts provide graphic depictions of trends and confidence intervals, but unlike the Mann-Kendall and Sen's Slope Estimator, regression control charts are parametric tests that assume a linear relationship between two variables. Regression-based methods focus mainly on monotonic, long-term trends and generally assume that individual observations can be ranked into two ordered series (for example, sampling dates and concentrations). Tests may give a value -- such as the Pearson product-moment correlation coefficient -- that indicates the strength of the correlation between the two variables.

Trend analysis can be used to evaluate whether the concentrations of a constituent within a single well have increased or decreased over a particular time period. Data will be evaluated in the O&M report to ascertain if contaminant concentrations in each well show statistically significant increases or decreases over time. The critical question for the Delatte site is, "Are concentrations of COCs in groundwater sampled at site and compliance wells increasing or decreasing over time, as shown by trends in concentrations at each well?" Several different methods that may be used to evaluate concentrations trends in the Delatte wells are described in the following sections.

Mann-Kendall Test for Trend

The Mann-Kendall test does not require that data be normally distributed. This test lists the data in temporal order and evaluates each pairwise slope of the time-ordered data. The test statistic is the difference between the number of positive and the number of negative differences. A negative value for the test statistic indicates decreasing values over time, whereas a positive value for the test statistic indicates increasing values over time. The test statistic provides a measure of upward and downward trends, but the confidence in a trend is provided by the probability value (p-value) for the Mann-Kendall test, which indicates the confidence with which the null hypothesis may be rejected.

The null hypothesis for the Mann-Kendall test states that there is no temporal trend in the data values; therefore, the p-value provides the level of confidence for rejecting the null hypothesis. For example, a p-value of 0.01 indicates 99 percent confidence that a real trend exists. A p-value of 0.05 indicates 95 percent confidence that a real trend exists, a p-value 0.10 indicates 90 percent confidence that a real trend exists, and a p-value of 0.20 indicates 80 percent confidence that a real trend exists.

Sen's Slope Estimator

Sen's slope estimator is a nonparametric method for estimating a slope that computes slopes for all pairs of ordinal time points, then uses the median of these slopes as an estimate of the overall slope. Sen's slope estimator is the median of all the n(n-1)/2 pairwise slopes. This approach differs from linear regression analysis, which evaluates a "best fit" overall, based on least squares regression rather than calculating a slope between each data pair.

If there is no consistent upward or downward trend in the data pairs, Sen's would be a value near zero (any random upward or downward directions cancel out). If the underlying trend is downward, Sen's estimator is a negative value; if the underlying trend is upward, Sen's estimator is a positive value. The magnitude of Sen's estimate does not necessarily connote statistical signficance, which is why other methods are used in conjunction with Sen's method.

Kendall Tau Test

Kendall's tau is a nonparametric measure of association based on the number of concordances and discordances in paired observations. Concordance occurs when paired observations vary together, and discordance occurs when paired observations vary differently. The Kendall tau test evaluates data for trends and produces a p-value that indicates the probability that the trend is "real" or due to chance alone. In this, the Kendall tau test differs from other trend tests that provide only the degree of fit to an estimated trend line. The lower the Kendall tau p-value, the more likely the trend is "real" and that the arrangement of data points is not due to chance only. For example, if the p-value from the Kendall tau test is 0.0100, there is a high probability (99 percent) that the trend is real; that is, there is less than a one percent probability that the arrangement of data points is due to chance alone. Conversely, if the p-value is 0.7506, then there is a 75 percent probability that the arrangement of data points is due to chance alone. The sign of the z-values and tau values indicates whether the trend is increasing (positive values) or decreasing (negative values) over time.

Regression Control Charts

Regression-based methods focus mainly on monotonic, long-term trends and generally assume that individual observations can be ranked into two ordered series (for example, sampling dates and concentrations). Tests may give a value -- such as the Pearson product-moment correlation coefficient -- that indicates the strength of the correlation between the two variables.

The general idea of the regression control chart is that the control limits established in the regression control chart will allow detection of a change in the relationship between the two variables (here, sampling date versus concentration). Unlike nonparametric tests, the regression control chart contains a regression line that assumes and summarizes the linear relationship between the two variables of interest. The individual data points are also shown in the same graph. Around the regression line are confidence intervals within which a certain proportion (e.g., 95 percent) of samples may be expected to fall, at about two standard errors of the estimate of the regression line. Outliers in this plot may indicate samples where, for some reason, the common relationship between the two variables of interest does not hold. A 95 percent confidence interval is the range of concentrations that has a 95 percent probability for containing the true concentration on a given date. Control limits lie outside the confidence intervals at about three standard errors of the estimate of the regression line and are used to mark "extreme" values. These control limits may not appear on every graph because they may lie outside the boundaries of the graph.

COMPARISONS OF UPGRADIENT VERSUS DOWNGRADIENT WELLS

In general, statistical tests used to compare two populations can be defined as parametric and nonparametric. A parametric test assumes that the data are normally (or lognormally) distributed. The characteristics of a normal distribution are specifically defined (Gilbert 1987) and follow the familiar bell-shaped curve. A nonparametric test "does not depend for its validity on the data being drawn from a specific distribution" (Gilbert 1987) and is, therefore, a "distribution-free" technique. Nonparametric tests require fewer assumptions about the data sets than do parametric tests, although both types of tests require that data be collected as random and independent measurements. For both parametric and nonparametric tests, there are "one-sample" and "two-sample" tests.

Two-sample parametric tests include the two-sample t-test. Nonparametric tests include the Wilcoxon Rank Sum (WRS), the Quantile test, and the Slippage test. The WRS and the Gehan tests compare the median values of two data sets, whereas the Quantile and Slippage tests examine the data values in the upper portion of the distributions of the two data sets. The WRS and Quantile tests will be used for statistical comparisons of the site and background populations in this investigation. These two tests are complementary and evaluate different aspects of the populations. As described in EPA guidance (2000a), when the WRS test is "applied with the Quantile test, the combined tests are most powerful for detecting true differences between the two population distributions."

Wilcoxon Rank Sum Test

The WRS test is conducted to test whether measurements from one population tend to be consistently larger than those from another population. This test is a nonparametric version of the two-sample Student's t-test. The WRS test uses ranks instead of the actual data values and does not require the data sets to be normally (or lognormally) distributed; however, approximately equal variance is assumed. If both data sets are normally distributed and the number of data in both data sets is large, the WRS test is 95.5 percent as powerful as the traditional Student's t-test. That is, it is 95.5 percent as likely that the WRS test will detect a difference between the data sets when a true difference exists. If one or both data sets are not normally distributed, the two-sample t-test can be less powerful than the WRS test. Slight additions to the standard WRS test allow adjustments for ties in rank and for smaller sample sizes.

Assumptions of the WRS test include the requirement that the data are random and independent. The WRS test also assumes that the two underlying distributions are similar in shape and dispersion; however, it is generally a robust test, in particular to the effect of outliers because ranks are used rather than the actual values. This use of ranks instead of actual values limits the influence of outliers because any given data point can be no more extreme than the first or last rank (EPA 2000). The WRS test may, however, produce misleading results if many data values are the same (ties in rank); therefore, the optional correction for ties in rank was specified in the computer output. The procedure and examples for conducting the WRS test are described in detail in published sources (Gilbert 1987;EPA 2000).

Procedures for the WRS test include calculation of the probability p of obtaining the test statistic by chance alone. If calculated p-values are less than a critical value for a given level of significance (for example, p less than 0.05), then it is concluded that the median concentration at the site is statistically greater than the median ambient concentration, and the chemical is identified as a COPC. If the Type I ("false positive" also called "false rejection") error rate of the WRS test is set at 0.05, then if the calculated p is greater than or equal to 0.05, there is insufficient evidence to reject the null hypothesis that the true medians of the site and background data sets are equal; that is, there is insufficient evidence to conclude that the true median of the chemical concentration in site soil exceeds the true median of the concentration in background soil. The WRS test will be applied to only chemical constituents that had a rate of detection greater than 50 percent.

Quantile Test

If the distributions of the two data sets appears to be equivalent but there are unresolved questions about some site data in the upper percentiles of the distribution, the Quantile test may be applied to address this question. The Quantile test is used in conjunction with a test such as the WRS and is a nonparametric, two-population test that was developed for comparing the right-hand tails or upper quantiles of two distributions. The Quantile test can be used in cases where some proportion of large responses (rather than the entire distribution) of one population has shifted relative to a second population. The Quantile test is not as powerful as the WRS test when the distribution of site concentrations is shifted in its entirety to the right of the ambient distribution. However, the Quantile test is more powerful than the WRS test for detecting cases where only a small number of high-value measurements are present in the upper quantile of the site distribution. For this reason, EPA (2000) recommends that the Quantile test be used in conjunction with the WRS test. When they are applied together, these tests have higher power to detect true differences between the distributions of two populations. The Quantile test may be applied to data sets with a greater proportion of nondetections than the WRS test, as long as the values included in the test are not high-value nondetections. The Quantile test can accommodate a fairly large percentage of nondetected values because it ignores the low end of the data distribution.

The Quantile test is easy to apply. It consists of examining the largest r measurements in the pooled (and ordered) site and ambient data sets and counting the number of r measurements that are from the site. If k or more of the r measurements are for the site, the Quantile test declares that the upper range of concentrations at the site is elevated relative to the ambient population. The Ho addressed by the Quantile test is that $e < 0$ and $D/s < 0$, where e is the proportion of site measurements that have shifted to the right and D/s is the magnitude (in units of standard deviation, s) of the shift.

References

EPA (2000) Guidance for Data Quality Assessment: Practical Methods for Data Analysis. EPA QA/G-9. EPA/600/R-96/084. July.

Gilbert, R.O. (1987). Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York. 320 pp.

APPENDIX F

LANDOWNER CONTACTS

(INFORMATION IN APPENDIX F IS NOT PROVIDED BASED ON THE PRESENCE OF PRIVATE PERSONAL DATA)

ATTACHMENT B

DELATTE METALS O&M SPECIFICATIONS (SEPTEMBER 2016)

Attachment 1 - Specifications
RFx No. 3000006312 Title: Delatte Metals O&M - DEQ

"Operation and Maintenance at the Delatte Metals Superfund Site" AI No. 2328
Louisiana Department of Environmental Quality

1.0 INTRODUCTION

According to the Superfund State Contract between the Louisiana Department of Environmental Quality (the Department) and the U.S. Environmental Protection Agency (USEPA), the Department is responsible for providing Operation and Maintenance (O&M) at the Delatte Metals Superfund Site, located south-southeast of Hammond, Louisiana. The Department invites all interested and qualified parties to submit bids to provide the services required for these activities as described below. As specified in the National Contingency Plan (NCP) and the Superfund State Contract, the State is required to continue O&M activities at the site during which time the USEPA will continue to provide regulatory oversight.

1.1 BACKGROUND

The 19-acre Delatte Metals Superfund Site includes the Delatte Metals, Inc. facility and the abandoned North Ponchatoula Battery Facility. The two sites are aggregated because they are adjacent, performed identical lead salvage operations, and generated the same type of waste, with the exception that Delatte Metals, Inc. operated a lead smelter to recover additional lead materials. Delatte Metals, Inc. began operation in the early 1970's as the Fuscia Battery Company and ceased operations in 1993. The Ponchatoula Battery Company moved its operation adjacent to the Delatte and Fuscia Battery Company between 1972 and 1978.

The physical location of the site is approximately 5.5 miles south-southeast of Hammond, Louisiana, and 1.5 miles southeast of Ponchatoula, Louisiana. The site lies to the north of Weinberger Road, in a rural area with numerous residences within a one-mile radius of the site. The surrounding area is used for growing crops such as bell peppers, strawberries, and soybeans. Minor amounts of land are used for harvesting timber. The site is bounded by Weinberger Road and residences to the south, drainage ditches and residences to the north and east, and Selser's Creek and a residence to the west.

During State and EPA investigations, discharge from the facilities showed a pH range from 0.55 to 2. Analytical samples from on-site soil and groundwater samples indicated the presence of heavy metals including lead, arsenic, and cadmium. An observed release of lead and cadmium to Selser's Creek was documented by the analytical data from the sediment samples collected at three probable points of entry.

Remedial action (RA) operations costing approximately $14 million began on November 18, 2002 and the site construction completion was completed on September 22, 2003. During the RA, the principle threat wastes were excavated, immobilized, and transported offsite for disposal. A permeable treatment barrier (PRB) wall was installed to neutralize the acidity of the shallow water-bearing zone (WBZ) and limit the migration of dissolved metals. A groundwater monitoring program will be used to ensure the effectiveness of the selected remedy. Continued groundwater monitoring will include sampling to determine that the groundwater pH downgradient of the PRB is increasing, that metal concentrations in groundwater downgradient of the PRB is decreasing, and that metal concentrations in the groundwater of the third WBZ are not increasing.

In 1996, the State of Louisiana referred the site to EPA. On September 22, 2004, one year after the Preliminary Close-Out Report was signed and operational and functional period began, EPA turned over the site to the State of Louisiana.

1.2 Modifications to the Operation and Maintenance Program

Historically, long-term groundwater monitoring for the previous Department's O&M contracts consisted of the sampling of a total of 31 on- and off-site facility monitoring wells installed during the Remedial Facility Investigation (RFI) and RA. Five of the 31 wells monitored are water wells that are currently being used or can potentially be used for public consumption. These monitoring and water wells were historically sampled on a quarterly basis.

Based on the findings of the USEPA Office of Inspector General's (OIG) Site Evaluation (2008), additional studies were conducted by the USEPA and the State to address the concerns presented by the OIG in their report. The USEPA and Department studies were conducted to evaluate whether the groundwater plume present in the first WBZ could potentially be impacting Selzer's Creek as the plume migrates through and around the ends of the PRB. The studies consisted of the installation of additional groundwater monitoring wells, which were installed by the USEPA and United States Geological Survey (USGS) to further evaluate the groundwater quality of the first WBZ cross-gradient, up-gradient and down-gradient of the PRB as well as within the PRB. The USGS soil/borings/monitoring wells were also installed to define the lateral extent of the first WBZ, which appears to be a sand channel cut that is isolated to the northern end of the site. Additionally, a study was conducted by the USEPA Environmental Response Team (ERT) to evaluate the groundwater to surface water interaction between the first WBZ and Selzer's Creek and to evaluate ecological impacts to the creek. The USEPA's Optimization Group also evaluated the historical groundwater data to determine if the monitoring program was meeting the needs of the Record of Decision (ROD) and whether it could be optimized to improve the existing O&M program.

Based on the findings of these additional studies, the EPA and the State concluded that the previous O&M Program should be revised to reflect the conclusions and recommendations provided in the new studies. These recommendations were implemented in the modified O&M Program. The modified O&M Program consists of the following:

- The existing 22 RFI and RA monitoring wells screened in the first WBZ and second WBZ will be sampled on a semi-annual basis.
- The four RFI and RA monitoring wells located in the third WBZ will be sampled on an annual basis.

- The five residential water wells (WW-04, WW-09, North Well, South Well and [redacted] Well) will be sampled on a quarterly basis.
- Six permanent USEPA ADA monitoring wells and one temporary well were added to the program and these wells will be sampled on a semi-annual basis. The monitoring wells selected for sampling include the following: NWGS-01, NWGS-02, NWGS-03, NWGS-04, NWGS-05, NWGS-06 and TEPA-P7D (refer to Exhibit A).
- The USGS installed six permanent monitoring wells as part of the modified O&M Program and these monitoring wells will be sampled on a semi-annual basis. The monitoring wells selected for sampling include the following: GSGP-03, GSGP-06, GSGP-15, GSGP-18, GSGP-19 and GSGP-22. (refer to Exhibit A)
- The collection of surface water samples were added to the modified O&M Program and these samples will be collected on a semi-annual basis. The samples will collected from the following EPA ERT established sampling locations: two surface water samples from the north tributary (CL-05 and CL-19), two samples from Selzer's Creek at the confluence of the northern and southern tributaries (CA-51 and CA-41), which is directly downgradient from the Delatte Metals property and one sample will be collected near the bridge at Esterbrook Road to serve as the up-gradient sample location (refer to Exhibit A). The surface water samples will be analyzed for the same constituents of concern (COCs) as the monitoring wells. The metals will be analyzed on a total and dissolved basis. The surface water samples CA-51 and CA-41 collected from Selzer's Creek shall be collected approximately five feet from the bank that is directly adjacent to the Delatte Metals property. The surface water sample collected near Esterbrook Road shall also be collected five feet from bank of Selzer's Creek; however, either bank can be used for sampling. All surface water samples from Selzer's Creek should be collected at approximately half the distance from the bottom of the creek bed. The surface water samples collected from the northern tributary shall be collected from the middle of the tributary.
- The COCs list for the site will consist of the following metals: arsenic, cadmium, lead, manganese, nickel, and zinc. These metals will be analyzed on a total and dissolved basis. Additionally, the RFI/RA monitoring wells and USEPA TEPA series wells located in the first WBZ and down-gradient of the PRB will also be sampled for sulfides and sulfates and include the following wells: MW-01, MW-02, DW-03, DW-04, BA-09, GSGP-22 and all the TEPA Series wells.
- Quarterly reports will be submitted to the USEPA Region 6 and the Department for the five residential water wells. The third WBZ annual groundwater data shall be included within the semi-annual monitoring report that coincides with the third WBZ sampling event. Therefore, a total of six reports will be prepared and submitted to the USEPA Region 6, the Department and the Tangipahoa Parish Library in Ponchatoula, Louisiana. The Contractor shall submit a hard copy of the report by mail to the Ponchatoula Library located at 380 North Fifth Street, Ponchatoula, Louisiana 70454.

1.3 Site Files

The Delatte Metals Superfund Site (AI # 2328) Administrative Record is available for review at the Department (see below) or at the Ponchatoula Public Library.

The Louisiana Department of Environmental Quality (the Department) provides access to public records regarding any regulated facility through the Electronic Document Management System (EDMS). The EDMS is available at http://www.deq.louisiana.gov/portal/ONLINESERVICES/ElectronicDocumentManagementSystem.aspx. Should assistance be required, a Public Records Technician is available during business hours to assist members of the public with the use of the EDMS. The Department also provides access to EDMS in the Public Records Center located in Baton Rouge in Room 127, Galvez Building, Department Headquarters, 602 North Fifth Street, Baton Rouge, LA 70802 (ph. (866) 896-LDEQ). The Public Records Center is open every business day from 8:00 am until 4:30 pm. Public Records Centers are also available at each of the Department Regional Offices.

Visitors to the Public Records Center are charged $0.25 per printed page. Some visitors qualify for the reduced rate of $0.05 per page or free copies. Charges are payable by check or money order. Charges of $5.00 or less may be paid with cash in exact change when visiting the Baton Rouge Public Records Center.

2.0 RESOURCES

Resource information for this project is provided below.

2.1 Operation and Maintenance Manual

The document listed below can be found at
http://www.deq.louisiana.gov/portal/Portals/0/remediation/DELATTE_METALS_OM.pdf

(1) Site Operation and Maintenance Manual (O&M Manual) which includes:
   (a) Standard Operating Procedures (SOP)
   (b) Tables
   (c) Figures
   (d) Trend Analysis Information
   (e) Landowner Information

2.2 Guidance for Preparation of the Quality Assurance Project Plan

The Quality Assurance Project Plan (QAPP) shall be developed in accordance with *EPA Requirements for QAPPs* (QA/R-5). For additional guidance, the contractor shall use *EPA Guidance for QAPPs* (QA/G-5). Both of these documents can be found at:

https://www.epa.gov/quality/epa-qar-5-epa-requirements-quality-assurance-project-plans and https://www.epa.gov/quality/guidance-quality-assurance-project-plans-epa-qag-5-december-2002

3.0 PROJECT-SPECIFIC LAWS AND REGULATIONS

The Contractor shall, on his own time and at his own expense, secure all permits, licenses, and certificates that may be required of him by law for the performance of the requirements of the contract. The Contractor and its employees, subcontractors, and agents shall comply with all federal, state and local laws, ordinances, rules, and regulations relating to the performance of this work.

The Contractor shall maintain LA State Contractors License as outlined in the bid Special Terms & Conditions.

In accordance with LAC 33:I.4501, any commercial laboratory (as defined in LAC 33:I.4503) shall be accredited by the Louisiana Environmental Laboratory Accreditation Program (LELAP) prior to commencing analytical work. Each such laboratory must be certified for the method/matrix/analytes necessary to perform the analytical work required. The Department shall not accept analytical data generated by any commercial laboratory that is not accredited by LELAP in accordance with LAC 33:I.4501 through 5915. All analytical data must be submitted in a format approved by the Department Project Manager and shall meet the requirements of LAC 33:I.5313 and the 2003 National Environmental Laboratory Accreditation Conference (NELAC) Standards.

4.0 PROJECT MANAGEMENT

The Contractor shall provide the methods and resources (personnel, supervision, materials, supplies, and equipment) necessary to perform the tasks described in these Specifications. All equipment must be in good working order and available to the Contractor when needed, whether Contractor-owned or leased. The contractor shall provide all support equipment and accessories necessary to operate and maintain the equipment. All lifting equipment must comply with OSHA requirements. All instrumentation must be in sound working condition and calibrated prior to use.

The Contractor shall plan and supervise all tasks efficiently and with his best skill and attention. He shall be solely responsible for the methods, techniques, procedures, and sequencing of work.

4.1 Personnel/Company Qualifications and Experience

The Contractor shall provide, at all times, experienced and competent personnel for the execution of the work described in this Contract. Due to health and safety requirements, no fewer than two personnel shall be allowed to perform on-site work.

The minimum qualifications for Contractor personnel assigned to the operation and maintenance of the site shall include qualifications as specified in Attachment A - Terms & Conditions of this ITB document. The Department reserves the right to require the replacement of any person assigned to work on this project who is determined to be unresponsive to the needs of the Department as defined by the contract.

4.2 General Site Management

This section is included as a general description of the site. It is intended to provide the Contractor with a general understanding of the groundwater monitoring system. A more thorough description of the system can be found in the Delatte Metals Remedial Investigation Report, January 2000 by Tetra Tech and Delatte Metals Final Design Report, January 2001, by Tetra Tech, available via Department Public Records (EDMS) and Ponchatoula Library.

The site currently has no available utilities, and such utilities will not be provided by the Department. The Contractor is responsible for providing any necessary utilities.

The Contractor shall be responsible for the protection and safety of all work, materials, equipment, and other property on the site against vandals and other unauthorized persons during mobilization, on-site work, and demobilization. No claims shall be made against the Department by reason of any act of an employee or trespasser. All damage, injury or loss to any property caused directly or indirectly, in whole or in part, by the Contractor shall be remedied by the Contractor at his expense.

The Contractor shall perform routine, preventative, and corrective maintenance of all onsite equipment. The Contractor shall maintain the appearance of the overall site in a clean and orderly manner acceptable to the Department. Bidders are reminded that **no** equipment will transfer with the contract.

General site maintenance shall include clearing and maintaining a path to all the wells, maintaining the integrity of the wells, as well as repairing damaged wells and well pads, if needed. Additionally, quarterly inspection of the permeable reactive barrier wall (PRB) and surrounding land in the immediate vicinity of the PRB shall be performed to assess if any subsidence is present at and or near the PRB. **Based on the current conditions of the site and PRB, the Department is requiring that 200 cubic yards of clean fill material be used to fill low lying areas near the PRB and areas within the PRB that are exhibiting subsidence. This task will need to be performed upon initiation of the project once it is awarded.** Fill placed in the PRB shall be compacted using the weight of the heavy equipment used to grade the fill in place. No compaction testing shall be required for placing of the fill material. The cost for clean fill material, labor, equipment and transportation should be included in the bid. Additionally, a per cubic yard cost should be included in the bid in the event additional fill material is needed in the future due to unforeseen circumstances impacting the PRB. This additional task shall be performed only with prior verbal approval by the Department Project Manager.

Additionally, the contractor will have to maintain and repair the limestone rock access road that leads from the former location of the lead smelter building to the section of the site that contains the PRB. The former lead smelter building location is currently concreted. This task will consist of the filling in of the current areas of the road with an appropriate type of fill material, if required, and then returned to grade. Upon completion of grading, the contractor will obtain limestone rocks to line the areas of the access road that currently require repair. The limestone base should consist of a 3 inch thick layer of limestone rock which will not exceed ten feet in width. **Based on the current conditions of the access road, the Department has calculated that 15 cubic yards of limestone rock is needed to address the areas of the access road that require repair. Grey 57 is the preferred limestone rock to use for road preparation; however, Grey 610 is acceptable. This task will need to be performed upon initiation of the project once it is awarded.** Limestone used to repair the access shall be compacted using the weight of the heavy equipment used to grade the material in place. No compaction testing shall be required and the cost for material, labor, equipment and transportation should be included in the bid.

In the event additional repair is needed in the future due to unforeseen circumstances impacting the access road, the Department will handle this on a case-by-case basis. This additional task shall be performed only with prior verbal approval by the Department Project Manager.

4.3 Schedule

The Contractor shall initiate the project within the time frame set out in schedule below. All activities shall be completed within the stated maximum number of <u>calendar</u> days from the date of the Notice to Proceed issued in writing by the Department. Adherence to the following schedule will be determined by the Department.

Project Initiation Schedule

Time Frame	Activity
Within 10 calendar days of Purchase Order Issuance	Commencement Conference (at Department Headquarters in Baton Rouge or on-site)
November 1, 2016	(Pending Purchase Order Approval Date) Beginning quarter for status as primary contractor (First sampling event for quarter ending Dec. 2016 may occur in November or December 2016 due to Commencement Conference and QAPP preparation/approvals)
Within 20 calendar days of Purchase Order Issuance	Preparation / Submittal of Draft QAPP (note: on-site activities as prime contractor shall not occur until Department approval of the QAPP, unless approved by the Department in special circumstances).
Within 30 calendar days of Purchase Order Issuance	Deadline for Department Review of QAPP
Within 35 days of Purchase Order Issuance	Revisions / Submittal of Final QAPP
30 days following the end of each quarter (beginning quarter ending Dec. 2016)	Submittal of quarterly monitoring reports
30 days following the end of each semi-annual period	Submittal of semi-annual monitoring reports

Within 60 calendar days of Purchase Order Issuance	Preparation / Submittal of Revised O&M Manual
Within 80 calendar days of Purchase Order Issuance	Deadline for Department Review of Revised O&M Manual
Within 100 calendar days of Purchase Order Issuance	Revisions / Submittal of Final O&M Manual

4.4 Submittals and Deliverables

Submittals shall be sent according to the following procedures. Three copies of all reports shall be mailed to:

Gary A. Fulton, Jr., Administrator
Underground Storage Tank and Remediation Division
P.O. Box 4312
Baton Rouge, LA 70821-4312

4.4.1 Quarterly & Semi-Annual Operational Reports

A quarter shall be defined as three months of O&M. Within thirty (30) days after the end of each quarter of O&M, the Contractor shall submit a quarterly groundwater monitoring report to the Department. Within thirty (30) days after the end of each semi-annual period of O&M, the Contractor shall submit a semi-annual groundwater monitoring report to the Department.

The quarterly and semi-annual monitoring reports shall include the Contractor's name and address, the name of the Project Manager, Department's purchase order number and project title, a narrative summary of the quarter's operations, and a data summary table providing quarterly and cumulative quantities for the following items:

(1) A facility map showing all monitoring wells and depict their status, i.e., assessment, recovery, P/A, and surface water sampling locations, etc;
(2) A table showing well number, well depth, screened interval, zone monitored, well diameter, casing material, and type of dedicated equipment, i.e., pump, bailer, etc. for each well;
(3) A table showing the sampling and reporting schedule for each well and surface water sampling location at the facility;
(4) A table showing the tests performed for each well and the specific constituents of concern;
(5) A summary of analytical data for all monitoring wells and surface water samples for the reporting period;
(6) A discussion of any significant changes from the previous reporting period in the analytical data from all monitoring wells for the reporting period;
(7) Contaminant concentration isopleths for each monitored zone for the reporting period;
(8) Water level measurements and potentiometric surface maps for each zone monitored for the reporting period;

(9) Concentration versus time graphs for all monitor wells installed to monitor the effectiveness of the recovery system;
(10) Copies of lab data reports, along with validation reports;
(11) Original field forms / notes; and
(12) Other pertinent information or discussion.

Quarterly and Semi-Annual Reports shall include a comparison of the quarterly and semi-annual sampling results to the statistical analysis. All semi-annual reports shall include a trend analysis (concentrations versus time graphs) for all monitoring wells. Please note that the data obtained from monitoring wells sampled on an annual basis will be included within the semi-annual report that coincides with that semi-annual sampling event.

5.0 SITE HEALTH AND SAFETY REQUIREMENTS

The Contractor shall be responsible for the health and safety of his employees during the performance of all activities required by this contract. The Contractor shall maintain and comply with a Health and Safety Plan (H&SP) consistent with Section 104(f) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended, EPA Order 1440.3, all Occupational Health and Safety Administration requirements, Hazardous Waste Operations and Emergency Response (HAZWOPER) training in accordance with 29 CFR 1910.120, and all applicable federal, state and local laws, regulations, ordinances, and codes used in planning and implementing site health and safety. In the event of conflict between any of these requirements, the more stringent requirement shall be followed.

For safety considerations, no fewer than two (2) O&M Contractor personnel shall be within sight or earshot of each other during hazardous operations (working at heights, handling heavy equipment, etc.). A First Aid Kit shall be maintained on-site at all times along with emergency telephone numbers.

The Contractor shall be responsible and take all necessary precautions for the protection and safety of personnel involved in site activities and affected personnel in the surrounding community. The Contractor shall provide protective clothing and respiratory protective equipment as appropriate for all personnel employed or retained for services.

Personnel Protective Equipment (PPE) shall be stored onsite until disposal. PPE shall be disposed offsite, at the contractor's expense, as necessary.

5.1 Safety Training of Personnel

Because this project requires work with potentially hazardous materials/ substances/ situations, all contract personnel who will work at the site must have completed a 40-Hour Hazardous Waste Operations and Emergency Response (Hazwoper) as prescribed in 29 CFR 1910.120 and maintained an 8-hour refresher course within a 12-14 month period from the date of the initial 40-Hour course. The Contractor shall include copies of each site worker's 40-Hour and 8-hour refresher of Hazwoper as applicable in the Health and Safety Plan. Hazwoper certification shall be maintained by all site workers for the duration of the project. Proof of re-certification acquired during the project shall be added to the Health and Safety Plan upon course completion.

Auxiliary services personnel such as equipment maintenance workers or common trash pick-up, etc, who will be working outside the hazardous areas and who will be on-site for a temporary basis only, will not be required to have 40-Hour Hazwoper. All auxiliary services personnel shall be escorted by the site manager or his designee at all times.

5.2 Medical Monitoring of Personnel

The Contractor shall ensure that his employee's physical condition will allow them to successfully perform their duties without physical harm or adverse health effects, especially when wearing protective clothing and equipment.

5.3 Exposure Monitoring

The Contractor shall perform occupational exposure monitoring, as applicable. Worker personnel protection equipment requirements shall be determined by the Contractor based upon monitoring results.

5.4 Decontamination

The Contractor shall install and ensure the proper use of personnel and equipment decontamination enclosures or stations as appropriate to contain hazardous materials or contaminated water when performing hazardous materials remediation activities.

5.5 Emergencies

In emergencies affecting the safety of persons, property, or the work, or adjacent entities thereto, the Contractor, without special instruction or authorization from the Department, is obligated to act to prevent threatened damage, injury, or loss. The Contractor shall give immediate notice to the Department at the time of the event's occurrence. Furthermore, he shall provide to the Department written documentation of the event referencing all resultant circumstances and any changes/deviations in the work, within three (3) business days.

6.0 DEPARTMENT RESPONSIBILITIES

As part of its responsibilities for this project, the Department will:

(1) provide points of contact for technical and contract activities (Project Manager and Contract Manager);

(2) observe and inspect the Contractor's work at the site;

(3) monitor the Contractor's work at the site; and

(4) review, require revision as necessary, and accept deliverables and submittals.

7.0 PAYMENT

The Contractor shall submit invoices for completed work to DEQ Accounts Payable, P.O. Box 4303, Baton Rouge, Louisiana 70821-4303 or at DEQAccountsPayable@la.gov. Invoices must identify tasks accomplished. Prices for each line item in the bid shall include all direct costs, indirect costs, and profit associated with that line item. Invoices must include the purchase order number and the name and address of the contractor. No items other than those included in the bid shall be billed; and unit price will prevail.

Invoices submitted for disposal shall include disposal facility tickets and/or manifests to verify quantity or units disposed.

DETAILED SPECIFICATIONS BY LINE ITEM

LINE 1 - ATTENDANCE AT COMMENCEMENT CONFERENCE

The Contractor shall attend a commencement conference at Department Headquarters in Baton Rouge or on-site within seven (7) days of award. The Contractor shall come to the conference prepared to request clarification of any issues not clearly understood by him. Line 1 shall be a lump sum. The Department reserves the right to waive the conference.

LINE 2 - PREPARATION AND REVISION OF O&M MANUAL & QAPP

The Contractor shall prepare and submit a revised O&M Manual and Quality Assurance Project Plan (QAPP) to the Department according to the timeframe listed in the schedule above. The Contractor shall abide by the EPA Requirements for O&M Manuals & QAPPs.

The Contractor shall submit three copies of the QAPP to:
Gary A. Fulton, Jr., Administrator
Underground Storage Tank & Remediation Division
P.O. Box 4312
Baton Rouge, LA 70821-4312

The Department will require revisions to the O&M Manual and QAPP as necessary. Line 2 shall be a lump sum and shall include all direct and indirect costs related to QAPP preparation and revision, as applicable. The previous QAPP is located in EDMS for reference, EDMS Document ID No. 9398265. The latest (2004) version of the O&M Manual may be found at
http://www.deq.louisiana.gov/portal/Portals/0/remediation/DELATTE_METALS_OM.pdf

LINE 3 - OPERATION AND MAINTENANCE AND RELATED (MONITORING WELL) ACTIVITIES

Line 3 shall be an Operation and Maintenance per well unit rate (due to the possibility in the future to discontinue the monitoring of some wells, which is not anticipated by the Department). The per well unit rate for Line 3 shall include all activities discussed in this Specification document (other than payment items listed separately above and below) as well as all activities described in the O&M Manual (after revision) referenced herein, as well as with the Contractor's QAPP approved by the Department. The O&M rate per well shall include, but not be limited to: project management, general site management, mobilization, health and safety considerations, sampling, sampling equipment, well inspections, preparation of wastes for disposal, transport of wastes, decontamination, demobilization, analysis, and data validation.

Note: Based on previous site work, individual semi-annual sampling events (on-site and off-site work) have lasted approximately one week. Please note this time will change based on the future modifications to the O&M Program, if required.

All on-facility monitoring wells must be sampled using low flow sampling techniques. Please refer to EPA website address list below for guidance on low-flow groundwater sampling procedures:

http://www.epa.gov/superfund/remedytech/tsp/download/gw_sampling_guide.pdf,
http://www.epa.gov/region9/qa/pdfs/finalsopls1217.pdf

Regarding validation, bidders are referred to the O&M Manual. Only 10% of the analytical data shall be validated. Due to validation, a level IV, fully-supported data package shall be required from the lab.

Please refer to the Operation and Maintenance Manual for specifics regarding sampling and analysis. Metals that will be sampled include: arsenic, cadmium, lead, manganese, nickel, and zinc. The samples shall be analyzed for total metals. If water quality parameters have stabilized within the allowable variances, and the turbidity is above 10 nephelometric turbidity units (NTU), the sampling team will collect a total and dissolved metals sample.

Additionally, specific monitoring wells will be sampled for sulfides (EPA Method 9034) and sulfates (EPA Method 9056). Refer to above section "Modifications to the O&M Program" for the specific monitoring wells selected for sulfide and sulfate testing.

Use of a CLP laboratory is not a requirement for this project; however, as listed in the bid document, the laboratory to be used must be accredited by LELAP. The required method is ILM05.2. For consistency, the Department will allow no substitute methods for this project.

Regarding **inspections**, the following process shall be followed:

Delatte Metals O&M Inspection Checklist

1. Visually inspect all monitoring wells.
   a. Are wells clearly labeled?
   b. Is there standing or ponded water?
   c. Is there evidence of collision damage?
   d. Is there evidence of frost heaving?
   e. Is there evidence of casing degredation?
   f. Are all wells locked?
   g. Is there evidence of well subsidence
   h. Were there any photos taken?

2. Visually inspect PRB cap.
   a. Is the soil overlying the PRB cracked, eroded, or show any other pathways that could allow for surface water to enter the subsurface?
   b. If subsidence results in low area developing over the PRB, additional soil may need to be imported the raise the soil higher than the surrounding areas to minimize infiltration.

3. Verify that all IC's remain in place.
   a. Inspect the deed files for the property during the time of sampling to ensure that IC's remain in place.
   b. Document any reuse of the Site to ensure that it is within the allowable parameter, industrial, as set by the IC.
   c. Report any additional information or discussion related to future reuse, either city planning or developer purchasing.

LINE 4 - O&M SURFACE WATER SAMPLE COLLECTION & ANALYSIS

- Line 4 shall be a per sample unit rate The per sample unit rate for Line 4 shall include all activities collection, analysis, equipment, supplies, labor, analysis, reporting, and data analysis. The samples will collected from the following EPA ERT established sampling locations: two surface water samples from the north tributary (CL-05 and CL-19), two samples from Selzer's Creek at the confluence of the northern and southern tributaries (CA-51 and CA-41) and one sample will be collected near the bridge at Esterbrook Road to serve as the upgradient sample location (refer to Exhibit A). The surface water samples will be analyzed for the same COCs as the monitoring wells (metals). Metals will be analyzed on a total and dissolved basis.

LINE 5 - PREPARATION OF QUARTERLY & SEMI-ANNUAL REPORTS INCLUDING HISTORICAL TREND ANALYSIS AND STATISTICAL ANALYSIS

The Contractor shall submit quarterly reports according to the Deliverables section above. The report shall be submitted according to the mailing procedures indicated above. The Department will review the report and provide comments as applicable. The Contractor shall address all Department comments, and revise the report as applicable. Line 5 shall be on a per report basis, to include initial preparation of the report, and revisions as applicable.

LINE 6 - RETURNING TO GRADE THE PRB AND AREAS NEAR THE PRB EXHIBITING SUBSIDENCE

The Contractor shall provide clean fill material, labor, equipment and transportation to return to grade areas of the PRB exhibiting significant subsidence as well as areas in the immediate vicinity of the PRB to prevent collapse of the wall. This work will be performed as directed by the Department. Line 6 shall be on a per cubic yard basis which shall include labor, material, equipment and transportation to bring clean fill material to the site. Receipts shall be provided to verify quantities; price may be blacked out on provider receipts. **Based on current conditions, 200 cubic yards of fill material will be needed to return the PRB and areas near the PRB to grade; however, it is anticipated that future events will not exceed a volume of 100 cubic yards for completion of this additional task if needed due to unforeseen circumstances and will be handled by the Department on a case-by-case basis in regard to the purchase order units.**

Line No. 7 through No. 13 are contingency, as-needed items with the exception of the initial projects of returning to grade the PRB and areas surrounding the PRB and the repair of the access road.

LINE 7 – RETURNING TO GRADE AND REPAIRING WORNED AREAS OF THE ACCESS ROAD

The Contractor will have to maintain and repair the limestone rock access road that leads from the former location of the lead smelter building to the section of the site that contains the PRB. This task will consist of the filling in of the current areas of the road with an appropriate type of fill material, if required, and then returned to grade. Upon completion of grading, the Contractor will obtain limestone rocks to fill in the areas of the access road that currently require repair. The limestone base should consist of a 3 inch thick layer of limestone rock which will not exceed ten feet in width. Line 7 shall be on a per cubic yard basis which shall include labor, material, equipment and transportation to bring limestone rock to the site. **Based on the current conditions of the access road, the Department has calculated that 15 cubic yards of limestone is needed to address the areas of the access road that require repair. Grey 57 is the preferred limestone rock to use for road preparation; however, Grey 610 is acceptable.**

LINE 8 - WELL LABELS

The Contractor shall replace well labels, as directed by the Department. The type of label shall be the same or equivalent as the labels currently on site. Line 8 shall be on a per label basis.

LINE 9 - WELL LOCKS

4.1 The Contractor shall replace well locks, as directed by the Department. The type of lock shall be the same as the locks currently on site (or equivalent). Line 9 shall be on a per lock basis. The Department will obtain a copy of all keys to well locks during the quarter ending

December 2016. The current locks will transfer with the site and will be replaced on an as-needed basis. If locks are damaged, the contractor will be required to replace the locks as directed by the Department.

LINE 10 - CONCRETE PAD

The Contractor shall replace well concrete pads, as directed by the Department. The type of concrete pad shall be the same as the concrete pads currently on site. Line 10 shall be on a per concrete pad basis. Characterization, transport, and/or disposal (as necessary) of the old material shall be considered an indirect cost and shall be built into the unit rate.

LINE 11 - WELL COVER

The Contractor shall replace well covers, as directed by the Department. The type of well cover shall be the same as the well covers currently on site. Line 11 shall be on a per well cover basis. Characterization, transport, and/or disposal (as necessary) of the old material shall be considered an indirect cost and shall be built into the unit rate.

LINE 12 - REPAINTING

The Contractor shall repaint individual wells, as directed by the Department. The repainting shall be in the manner of the wells currently on site. Line 12 shall be on a per well basis.

LINE 13 - POST REPLACEMENT

The Contractor shall replace well posts, as directed by the Department. The type of posts shall be the same as the posts currently on site. Line 13 shall be on a per post basis. Characterization, transport, and/or disposal (as necessary) of the old material shall be considered an indirect cost and shall be built into the unit rate.

LINE 14 - CLEARING ACCESS TO WELLS

The Contractor shall clear access to the wells to allow for on-site activities, only as directed by the Department. The contractor will only have to clear access to the wells to be sampled. It is not a requirement for the contractor to dispose of all cuttings upon completion of activities. The area cleared for the sampling events may be mulched in place. Line 14 shall be on a per clearing event basis.

LINE 15 - CHARACTERIZATION / PROFILING RELATED TO DISPOSAL, AS APPLICABLE

All characterization and profiling of waste material related to disposal shall be the responsibility of the Contractor. The bid for line 15 shall be a unit rate each characterization/profiling event, estimated 4, and shall include all direct and indirect costs related to waste characterization and profiling for disposal purposes. According to State regulations, hazardous waste may be stored on site for up to 90 days without a permit and must be disposed within the 90 day time frame, if applicable. Non-hazardous waste shall be disposed when the collected purge water is at 80% of the total volume of the drum.

Bidders are reminded that all records for this site can be found in Public Records per the Bid Special Terms and Conditions. The bid document allows bids for both hazardous and non-hazardous disposal costs, and reimbursement shall occur based upon characterization results. The Department cannot guarantee that materials will be categorized as non-hazardous.

LINE 16 - DISPOSAL OF DECON WATER AND PURGE WATER – HAZARDOUS

The Contractor shall dispose of all decon water and purge water at an appropriate permitted disposal facility according to applicable laws and regulations. Line 16 shall include all costs for disposing of decon water and purge water as hazardous and shall be on a per gallon basis.

LINE 17 - DISPOSAL OF DECON WATER AND PURGE WATER - NON-HAZARDOUS

The Contractor shall dispose of all decon water and purge water at an appropriate permitted disposal facility according to applicable laws and regulations. Line 17 shall include all costs for disposing of decon water and purge water as non-hazardous and shall be on a per gallon basis.

LINE 18 - DISPOSAL OF PPE, DISPOSABLE SAMPLING EQUIPMENT, ETC. - HAZARDOUS

The Contractor shall dispose of all PPE, disposable sampling equipment, and all other items that come into contact with purge water or decon water at an appropriate permitted disposal facility according to applicable laws and regulations. Such items shall be containerized into appropriate drums by the Contractor. Line 18 shall include all costs for disposing of PPE, disposable sampling equipment, etc. as hazardous and shall be on a per drum basis.

LINE 19 - DISPOSAL OF PPE, DISPOSABLE SAMPLING EQUIPMENT, ETC. - NON-HAZARDOUS

The Contractor shall dispose of all PPE, disposable sampling equipment, and all other items that come into contact with purge water or decon water at an appropriate permitted disposal facility according to applicable laws and regulations. Such items shall be containerized into appropriate drums by the Contractor. Line 19 shall include all costs for disposing of PPE, disposable sampling equipment, etc. as non-hazardous and shall be on a per drum basis.

ATTACHMENT C

EPA LOW-FLOW GROUND-WATER SAMPLING PROCEDURES

United States Environmental Protection Agency | Office of Research and Development | Office of Solid Waste and Emergency Response | EPA/540/S-95/504 April 1996

EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

[1]*National Risk Management Research Laboratory, U.S. EPA*
[2]*University of Michigan*

Superfund Technology Support Center for Ground Water

National Risk Management Research Laboratory
Subsurface Protection and Remediation Division
Robert S. Kerr Environmental Research Center
Ada, Oklahoma

Technology Innovation Office
Office of Solid Waste and Emergency Response, US EPA, Washington, DC

Walter W. Kovalick, Jr., Ph.D.
Director

chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

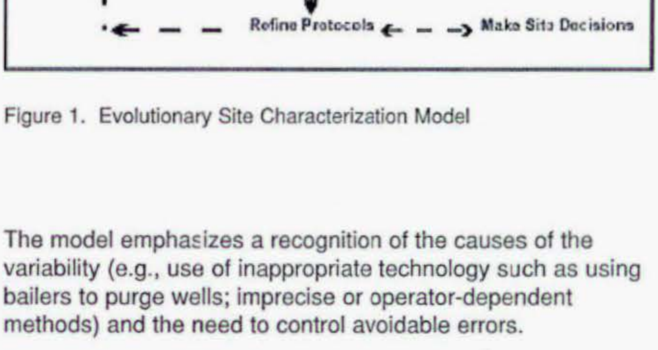


Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action.*

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations n the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over any other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described herein as part of its in-house research program and under Contract No. 68-C4-0031 to Dynamac Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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Figure 2. **Ground Water Sampling Log**

Project ______________ **Site** ______________ **Well No.** ____________ **Date** ____________________

Well Depth ___________ **Screen Length** _________ **Well Diameter** ________ **Casing Type** ____________

Sampling Device ______________ **Tubing type** ____________________ **Water Level** ________________

Measuring Point __________________ **Other Infor** ____

____

Sampling Personnel ____

Time	pH	Temp	Cond.	Dis.O_2	Turb.	[ ]Conc			Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project ______________ **Site** ______________ **Well No.** ____________ **Date** ______________________

Well Depth ___________ **Screen Length** _________ **Well Diameter** ________ **Casing Type** __________

Sampling Device ______________ **Tubing type** ___________________ **Water Level** ________________

Measuring Point _________________ **Other Infor** ____

____

Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi\ r^3$

ATTACHMENT D
FIELD FORMS

DELATTE METALS SUPERFUND SITE OPERATION AND MAINTENANCE ACTIVITY LOG

PROJECT GENERAL INFORMATION

Client: **LDEQ**

Date:

Facility #: **Delatte Metals Superfund Site**

Activities: **Notify facility of arrival. Inspect facility monitoring wells and PRB for integrity. Gauge, and sample appropriate wells.**

Address: **Weinberger Road, Ponchatoula, LA**

Project #: **207-0029**

SEMS ACTIVITY DOCUMENTATION (Continued On Back)

Time (Military)	Notes & Observations
Arrived : ( )	Notified facility personnel of arrival : YES NO Have H&S plan : YES NO

Potentiometric data collection procedures: Locate monitoring wells, open to allow for water level equilibration inspect/document well integrity, measure total well depth, measure depth-to-water (to 0.00'). Measure wells from least contaminated to most contaminated.

Well purging procedures: Use low flow micro purge methods and monitor water quality characteristics. When water quality characteristics stabilize record characteristics and collect sample. Transport purge water to on-site 55-gallon drums for containment and disposal.

Groundwater sample collection procedures: Collect samples with dedicated well equipment by low flow micro purge methods after water quality characteristics have stabilized. Transfer samples to a proper container (on ice) for transport to the designated lab for analyses. Ship samples for overnight delivery, with completed chain-of-custody documentation. Sample wells in the same order as they were purged.

Departed : ( )

SEMS EQUIPMENT & MATERIALS USED

Task	Description	Accounting Code	Unit	Quantity
03	Operation, maintenance and related activities per well.		well	
04	Surface Water sampling activities per well		well	
09	Well Labels		each	
10	Well Locks		each	
11	Concrete Pad		each	
12	Well cover		each	
13	Repainting		each (well)	
14	Post Replacement		each	
15	Clearing Access to wells		each (clearing event)	

SEMS PERSONNEL INFORMATION

Employee Name:

Employee Signature:

SEMS, Inc.

DELATTE METALS SUPERFUND SITE OPERATION AND MAINTENANCE ACTIVITY LOG

SEMS EQUIPMENT & MATERIALS USED

Task	Description	Accounting Code	Unit	Quantity
16	Characterization / profiling related to disposal		Each profile	
17	Disposal of Decon Water and Purgewater - Haz		gallon	
18	Disposal of Decon Water and Purgewater - Nonhaz		gallon	
19	Disposal of PPE, Haz		drum	
20	Disposal of PPE, Nonhaz		drum	

Employee Name: ______________________ Employee Signature: ______________________

SEMS, Inc.

Delatte Metals O&M Well Inspection Checklist

SEMS Project #: 207-0029

Field Crew: ______________________

____

____

Well No.	Date Inspected	Wells Labeled	Wells Locked	Post Condition	Paint Needed	Pad Condition	Well Access	Standing/ Ponded Water	Collision Damage	Frost Heaving	Casing Cegradation	Well Subsidence	Photos Taken	Notes

Delatte Metals O&M PRB Inspection Checklist

Page___of____

SEMS Project #: 207-0029

Field Crew: ______________________

____

____

Date Inspected ______________

Is the soil overlying the PRB cracked, eroded, or show any other pathways that could allow for surface water to enter the subsurface?	
PRB Cleared	
PRB Accessible	
PRB Cracks Identified	
PRB Erosion Identified	
Photos Taken	
NOTES:	

PRB=Permeable reactive barrier

s:/ethyl-tx/gw/forms/sals01.xls

Delatte Metals O&M QA/QC Checklist

Page___of____

SEMS Project #: 207-0029
Field Crew: ____
____
____

MS/MSD (Every 20 Samples)
Field Duplicate (Every 10 Samples)

MS/ MSD	Field Duplicate	Sample ID on COC	Sample Location ID of Original Sample (Field Duplicate)	Date	Time	Notes

LOW-FLOW GROUNDWATER SAMPLING LOG

Project: Delatte Metals Superfund Site
Project No.: 207-0029
Site Location: Ponchatoula, Louisiana
Monitor Well No.: ______
Date Purged/Sampled: ______ **Sampled By:** ______

MONITOR WELL INFORMATION

Total Depth of Monitor Well (**TD**): ______ ft.
Static Depth to Groundwater (**DTW**): ______ ft.
Screen Length (**SL**) from Boring Logs: ______ ft.
Depth to Top of Well Screen (**TD-SL**): ______ ft.
Height of Water Column (**H=TD-DTW**): ______ ft.

Purge Flow Rate: ______ mL/min
Volume Purged: ______ gallons
Date/Time of Sample: ______ @ ______ Time

WELL CASING VOLUME CALCULATIONS

☐ 2" Well (H x 0.163 gal/ft) ______ gal. (1 well volume) ______ gal. (3 well volumes)
☐ 4" Well (H x 0.653 gal/ft) ______ gal. (1 well volume) ______ gal. (3 well volumes)
☐ Other: ______

PURGING METHOD

☐ Peristaltic Pump
☐ Low-flow Submersible Pump
☐ Water Well
☐ Other (Specify)

METHOD OF SAMPLE COLLECTION

☐ Peristaltic Pump
☐ Low-flow Submersible Pump
☐ Bailer ☐ Dedicated ☐ Disposable
☐ Other (Specify) ______

LOW-FLOW MONITORING PARAMETERS

Time	Flow Rate	Temp.	Specific Conductivity	Dissolved Oxygen	pH	ORP	Turbidity	DTW
hr/min	mL/min	°C	mS/cm	mg/L	Standard Units	mV	NTU or FTU	feet
Targets	100 - 500 mL/min	+/- 1°C	+/- 3%	+/- 10%	+/- 0.1	+/- 10%	+/- 10% (if >10 NTU or FTU)	<0.3 ft. or Top of Screen

Notes: 1. Well is stable if 3 consecutive measurements of as many as 3 indicators are within their target ranges.
2. Take measurements every 3 to 5 minutes.

Total Metals Collected		Dissolved Metals Collected	

SHEET ______ OF ______

SURFACE WATER SAMPLING LOG

Project: Delatte Metals Superfund Site
Project No.: 207-0029
Site Location: Ponchatoula, Louisiana
Surface Monitoring Point No.: ______
Date/Time ______ **Sampled By:** ______

A. TYPE OF MONITORING POINT

☐ Stream ☐ Road Ditch ☐ Drainage Ditch ☐ Tributary ☐ Other

Description: ______

______

B. PURPOSE OF MONITORING POINT

☐ Downstream ☐ Upstream ☐ Other

Description: ______

______

C. MONITORING POINT CONDITIONS

General description/ condition of monitoring point: ______

______

______

Was monitoring point dry? ☐ Yes ☐ No
Too little water to sample? ☐ Yes ☐ No
Was water flowing? ☐ Yes ☐ No
Description: ______

______

D. FIELD MEASUREMENT

Weather Conditions: ______

______

Temperature (°C): ______
Specific Conductivity (mS/cm): ______
Dissolved Oxygen (mg/L): ______
pH (std. units): ______
ORP (mV): ______
Turbidity (NTU): ______

E. SAMPLE PARAMETERS

Sample analysis requested:

☐ Sulfides ☐ Sulfates
☐ Dissolved Metals ☐ Total Metals

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Pace Analytical
www.pacelabs.com

Section A **Required** Client Information:		Section B **Required** Project Information:	Section C Invoice Information:	Page: of
Company:		Report To:	Attention:	
Address:		Copy To:	Company Name:	**REGULATORY AGENCY**
			Address:	NPDES / GROUND WATER / DRINKING WATER
Email To:		Purchase Order No.:	Pace Quote Reference:	UST / RCRA / OTHER
Phone:	Fax:	Project Name:	Pace Project Manager:	**Site Location**
Requested Due Date/TAT:		Project Number:	Pace Profile #:	**STATE:**

Section D
Required Client Information

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

#	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	TIME	COMPOSITE END/GRAB DATE	TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	↓Analysis Test↓ Y/N													Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																																
2																																
3																																
4																																
5																																
6																																
7																																
8																																
9																																
10																																
11																																
12																																

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			

SAMPLER NAME AND SIGNATURE		Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER:					
SIGNATURE of SAMPLER:	DATE Signed (MM/DD/YY):				

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.08, 12-Oct-2007

ATTACHMENT E

QAPP REVIEW/ACKNOWLEDGEMENT

QAPP REVIEW / ACKNOWLEDGEMENT

I have reviewed the QAPP and understand my roles and acknowledge that the QA/QC procedures outlined in this plan area acceptable and achievable. I will report any deviations made from the QAPP plan to the SEMS Project Manager.

Approved by:

Name, Title: Richard W. Lee – Program Manager
Organization: SEMS, Inc. – President
Signature: [signature] Date: 1-23-17

Name, Title: Brian H. Sullivan, P.E. – Project Director
Organization: SEMS, Inc. – Regional Manager
Signature: [signature] Date: 1-31-2017

Name, Title: Brian E. Smith, P.E.– Technical Advisor and QA Officer
Organization: SEMS, Inc. - Vice President
Signature: [signature] Date: 1/23/17

Name, Title: Nick Rodehorst, P.E. – Project Manager
Organization: SEMS, Inc.
Signature: [signature] Date: 1/27/2017

Name, Title: Randy Shackelford- Project Manager

Organization: Pace Analytical Services

Signature: Randy G Shackelford Date: 1/26/17

Name, Title: Mike Stewart – Project Manager

Organization: Environmental Data Professional

Signature: MW Date: 1/26/17

Name, Title: ______

Organization: ______

Signature: ______ Date: ______

Name, Title: ______

Organization: ______

Signature: ______ Date: ______

Name, Title: ______

Organization: ______

Signature: ______ Date: ______

ATTACHMENT F

REFERENCES

REFERENCES

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